

When Masses Collide: A Theoretical Analysis of the
Structure of the Modern Operating Environment, the Forces
in Conflict and their Sources of Power

A Monograph
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ABSTRACT

When Masses Collide: A Theoretical Analysis of the Structure of the Modern Operating Environment, the Forces in Conflict and their Sources of Power by MAJ Simon J. Hulme, Royal Engineers, 75 pages.

The age of reductionism is over, new laws of physics are being discovered, and the old theoretical constructs are being replaced with new understanding. The modern operating environment in common with the world of physics has changed. This change, brought on by globalization and the increased integration of global communication, economic and informational systems, brings new challenges to those responsible for maintaining the security of the nation-state.

This monograph initially examines the current operational environmental models for the UK and USA assessing their relevance to theory in light of changes that have taken place globally since the publishing of those documents. The paper then examines the modern threat and environment in which that threat may act in order to place this combination into a theoretical construct. Chapter 5 presents a theoretical model based on the ideal gas law, for the modern operating environment following analysis of the future threat and future arenas of operation.

In conclusion, this monograph analyzes the effect of the thesis findings by briefly considering their implication on the standard campaign-planning model for the USA and UK. Further study in the area noted in the concluding chapter should be undertaken in order to refine this theoretical model, test the suppositions contained herein, and produce a better resolution with regard to the shape and structure of the future operating environment.

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ACRONYMS

ADP	Army Doctrine Publication (UK)
CIA	Central Intelligence Agency
COE	Contemporary Operating Environment (US)
DCSINT	Deputy Chief of Staff, Intelligence (US)
DGD&D	Directorate General of Development and Doctrine (UK)
DOD	Department of Defense (US)
EOW	Evolution of Warfare (UK)
FD	Force Development
FM	Field Manual (US)
FOE	Future Operating Environment (UK)
MOD	Ministry of Defence (UK)
NATO	North Atlantic Treaty Organization
PLA	Peoples Liberation Army
PRD	Perceived Relative Deprivation
QDR	Quadrennial Defense Review (US)
RMA	Revolution in Military Affairs
SDR	Strategic Defence Review (UK)
TRADOC	Training and Doctrine Command (US)
UK	United Kingdom
UN	United Nations
US (A)	United States (of America)
WAP	Warfare Amongst the People
WMD	Weapons of Mass Destruction
WWW	World Wide Web

CHAPTER 1

INTRODUCTION

Change means movement. Movement means friction. Only in the frictionless vacuum of a nonexistent abstract world can movement or change occur without that abrasive friction of conflict.

Alinsky, *The Purpose, Rules for Radicals*

Background

The increasing complexity of the world stage and the intricacies of integration across nations and corporations caused by the effects of globalization, has laid hurdles in the path of international military and political planners. Globalization has made communications easier with respect to many facets of life and events, but increased ease of communication has brought with it an increase in the level of international complexity. All those linked into the global network of commerce, politics, and communications, to name but a few, are now directly affected by the movement of others connected within the system; the World Wide Web (WWW) is not simply an internet phenomenon, it is an apt depiction of the whole global system. As Thomas Friedman explains in his analysis of increasing globalization, *The Lexus and the Olive Tree*, a decision made by the Thailand government in 1997 had an almost “butterfly effect” on the rest of the world’s economic markets.¹ By closing a majority of its finance houses thereby devaluing the Baht, the political powers in Thailand forced the development of a new form of commerce and bonding system and caused the collapse of economic markets all over the world.

One must consider why this is a relatively new or newly noted phenomenon. The keystone of global systems until 1990 was the bipolar world shaped by the NATO-Soviet Union Cold War. Although nations probably did not fully realize it at the time, the frozen state of East-West relations locked markets, politics, and even international relations in time, trapping the development of military and political systems with them. The dated cliché “the fall of the Berlin Wall,” marks the moment in time when those frozen values and positions began to thaw. Not

only did East-West relations warm metaphorically speaking, the state of the globally interlinked world did also. Physical movement increased; electronic movement leapt forward; these actions all leading to a much more flowing state of affairs, which in essence has proven difficult for decision makers worldwide to grasp, never mind quantify or even exploit fully.

Some have utilized this change in global nature, and it is they who now exploit the global reach of the electron, hide within the shifting system of the world, and use the power of international freedom to achieve their own ends. The era of nation-states, pitting wits against another on the battlefields of the world, may be numbered. Large nations, the former and emerging superpowers with nuclear capability are not the only forms of national threat in the future. The small group and even the individual can now directly threaten the large, as Major Chris Whitting articulated it in his master's thesis in 2001, "David [Can] Become Goliath."²

However, be it a nation or an individual who wishes to impose his will on another the surest and purest form of doing so is still by the application of violence. As Carl von Clausewitz articulates in his treatise *On War*, "in its most essential sense, [war is] nothing but a trial of strength."³ This fact has not changed, nor will it; the nature of pure conflict remains constant. The nature of the environment in which war takes place has changed.

The Static State of Solids and Liquids

One can imagine a conflict as two opposing masses colliding on a field of battle, with the victor being the one with the most men, or simply still standing at the end of the day. The analogy holds true particularly for battles waged before the Industrial Revolution. This form of warfare is almost two-dimensional, a *solid-on-solid* engagement where a simple collision of forces would decide the results of the war. Over time the size of operations and military actions grew to a scale where campaigns were fought over vast distances, armies consisted of hundreds of thousands of men which massed only occasionally on one battlefield, where the environment changed to an extent which made battles (the force-on-force aspect of war) infrequent and often

indecisive. As this phenomenon continued, assisted by developments in technology, a three-dimensional battlefield began to take shape where military operations seemed to flow from one collision to another. This situation is analogous to a *fluid* within which the solids (armies) move or float and sometimes collide. In keeping with this model, in the late twentieth century, the operations manuals of many Western armies instructed the military command to shape the battlefield in which they operated which loosely translated to commanders trying to force the opponent into areas of their own choosing, where collision between the two solids (forces) could take place.⁴ Although "battlefield" was replaced by the term "battle space," it meant essentially the same thing, but was an attempt at describing a loosely constructed three-dimensional model. The two-dimensional field no longer fitted into the concept of warfare--the new concept of warfare was bigger and growing with each advance in technology.

The Development of Gases

This fluid-like state continued throughout the twentieth century until the world began to see a change in the shape of the operating environment once again. The almost freezing effect of the cold war era locked technological positions and forcing the development of what was an increasingly less viscous liquid of world interaction, into the more solidified state that is common to most military commanders of today. The global-political situation of the mid-to-late-twentieth century can be likened to that of a block of ice floating in warm water; those nations trapped in the ice by diplomacy, ideology, or even simply the fear of the unknown cannot bring their forces to bear against another. Hence, the necessary mass-on-mass collision required for conflict could not take place. That having been said, around the edges (Afghanistan, Cuba, and The Falkland Islands, for example), where the ice was metaphorically melting, military action could take place and the masses could collide and did so, on a smaller scale. Major nation-on-nation conflict did not occur, and those conflicts that did have been termed small-scale contingencies (SSC).⁵

The collapse of the communist government in Russia and the issuing in of the new era were simply the start of the period of change that led to the position of the world today. It took time for the thawing of the global system after 1990 to be realized, a phenomenon which has only just been understood in recent years.

The tragic events of 11 September 2001 brought change yet again; focusing the attention of the United States of America (USA) and indeed the rest of the world on a "new" threat operating in a "new" environment. This threat was not new at all; planners had already named it asymmetrical, unconventional, and non-state (to name but a few terms already employed). Only now it had come to the fore, forcing nations to revisit their operating environment model once again. The threat may not be new, but the environment is. It is the product of the continued freeing of ties, a movement toward international fluidity caused by increased communication capabilities, the development and utility of which was fully unleashed when coupled with the metaphoric melting in 1991.

Absolute Zero

The new environmental model examined in this monograph exhibits the facets of all those type of matter that have gone before--solids, liquids and gases. Alvin and Heidi Toffler talk of waves of change, the agrarian, industrial, and informational eras, within which nations exist, grow, and develop.⁶ These waves exist concurrently, as do the forms of warfare described so far. Modern threats can employ both new and legacy equipment and methods; they can exist in an informational world, or an agrarian world. They can hide in the liquid, only exhibiting the characteristics of a solid when they are strong enough, in a position to do so and above all, when they wish so to do. They live and work in the gas that is the global environment, hiding in the Brownian motion of the worldwide population and its movements. This analogy is similar to that described and employed by Mao during the Chinese Revolutionary War.⁷ The modern environment in which the masses float is analogous to the state of matter expected to exist at

minus 273 degrees centigrade or zero degrees Kelvin. This physical point commonly known as absolute zero, the physical construct where matter can exist in all forms, that is for example, water, ice and steam but where no energy is exhibited has perhaps been illustrated metaphorically in the global operating environment of the new threat. In this case, however, movement and action can take place and energy can be exerted on one's opponent.

Scope

As one has seen, warfare has changed not just in its physical form, but also in its theoretical form. The commonly held Newtonian theories of early military theorists such as Clausewitz or Jomini are still applicable, but not for the reasons they were originally applicable almost 200 years ago. All of their theories would have one see solid-on-solid conflict. This idea is still applicable; the very nature of war (conflict) itself has not changed in its most basic form. At the operational and strategic level however, the threat has evolved, and the global environment in which that threat operates has changed dramatically since the Napoleonic era. This monograph intends to examine the applicability of the currently held theoretical constructs for the military operating environment. In doing so, it will examine the threat, the global environment and by combining the two, discuss a construct for the modern military operating environment. This construct will then be analyzed using several theoretical models. Finally, this paper briefly examines the impact of the final working model upon current campaign planning constructs and principles. The scope of the paper has been limited to the threats that face North Atlantic Treaty Organization (NATO) members and in particular the USA and the United Kingdom (UK).

Limitations and Delimitations

The only two limitations placed on this paper are that all information used in it will be of an unclassified nature and that methods of force employment in terms of tactics or doctrine will not be examined in this paper. However, all sources of unclassified information will be considered for inclusion in the monograph.

The Research Question

This monograph aims to analyze the applicability of the current operating environment model employed by the US and UK armies. In order to do so it will answer the question--Is the current theoretical construct for the military operating environment a valid model for the twenty-first century? Given this question, several secondary questions flow from it and are amplified in chapter 2.

Key Terms and Definitions

This monograph uses several physical constructs in order to establish the proposition of the thesis; these physical terms should be taken as purely metaphoric unless otherwise stated.

Assumptions

It is assumed that the threats that face the USA and UK are common across all NATO members and indeed are intrinsic to the threat to liberal democracy worldwide. This paper will therefore not delineate between the two nations, except for detailed examination of the force concept papers: Future Operating Environment (FOE), UK, and Contemporary Operating Environment (COE), USA.

An operating environment has two constituents, these being the combatants and the arena in which the threat could operate. The combatants clearly fall into either friendly or enemy actors, but only the enemy part of the combatant will be examined in this paper. Because of the global reach of the modern threat, the analysis executed in this monograph will be undertaken in both the strategic and operational spheres of military and political employment. This is done in order to allow for the change in the global environment toward an increased systemic order. It is unreasonable to expect military forces to operate without the political constructs necessary to sanction their employment. It is also unlikely that military forces will act alone, again without the support of other elements of national power. For purposes of this monograph, the US diplomatic, informational, military and economic (DIME) construct for the elements of national power will

be used.⁸ Chapter 5 also notes that the construct of the levels of war is perhaps better understood along functional lines rather than a hierarchical, because of the blurring of levels due to the makeup of the global structure.

Significance of the Study

Clearly, with the tragic events of 11 September 2001 the timing of this monograph is important. It aims to consolidate a majority of the work written both prior to and after the events in the US. This paper will perhaps be the first full study of the new operating environment since 11 September and as such should form the basis for the development of further thought, doctrine, and discussion.

Summary

The lens through which nations have viewed the operating environment and military affairs has changed over the years, whether nations have realized it or not. The changes during the early nineteenth century in the days of Napoleon (pre-industrial) were viewed through the eyes of a technological lens--useful when viewing a *solid*. More recently, a threat-focused lens was applied to military and political analysis, which is useful and apt when examining and understanding a *fluid*. Today, militaries need a new lens through which to see the world, a lens that can understand the *gaseous* nature of the new environment. As General Rupert Smith so aptly put it during the Kermit Roosevelt Lecture series in 2001, "We face a new a kind of war; a war amongst the people."⁹ This new war is a war in the gaseous state of the population, a state which will add more "fog" than Clausewitz ever considered possible within the simple *solid* nation-state model.

If absolute zero is a reasonable metaphor for the current operating environment and if the energy required to produce an effect or conduct combat, (collision) can only be released when the nature of the aggressor moves from the gaseous, through the liquid to the solid state then the nation-state still has several opportunities to counter threats in the new environment. It is a

requirement of the national security organizations to understand: the multi-state environment, the threats hidden in the gaseous environmental model, when and where they will become a solid in order to exhibit energy, and therefore force a collision with another mass trapped inside the gaseous sphere. At this point, the nation-state will be most effective; it will be able to apply force to the solid in a way that it understands and can control, and it will be able to shape the gas of the environment to form a liquid and then shape the liquid in order to bring the solid to the fore.

As with anything in nature, the most dangerous time is that point at which metamorphosis occurs: ask the butterfly. The new lens needs to be able to see the enemy in the gas, know his moves, project his changes, and compress the environment to force him to change his state.

¹ Thomas Friedman, *The Lexus and the Olive Tree* (New York: Random House Books, 2000), x.

² Chris Whitting, "When David Became Goliath: The Israeli Withdrawal From South Lebanon" (MMAS Thesis, Fort Leavenworth, Kansas: U.S. Army Command and General Staff College, 2000).

³ Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, New Jersey: University Press, 1984), 96.

⁴ U.S. Army, FM 100-5, *Operations* (Washington, DC; Department of the Army, 1993), 6-12.

⁵ U.S. Department of Defense, *The Quadrennial Defense Review Report, 1997* (Washington D.C.: Department of Defense, 1997). [Report online]; available from <http://www.defenselink.mil/pubs/qdr/sec4.html>; Internet; accessed 20 January 2002.

⁶ Alvin Toffler and Heidi Toffler, *War and Anti-War, Survival at the Dawn of the Twenty-First Century* (New York: Warner Books, 1993), 20.

⁷ Mao Tse Tung, *The Selected Works of Mao Tse Tung* [Article on-line]; available from <http://www.marx2mao.org/Mao/BSBA45.html>; Internet; accessed 5 March 2002, 81.

⁸ Edward Davis, Robert H. Dorf, and Robert D. Waltz, "A Brief Introduction to Concepts and Approaches in the Study of Strategy," in "U.S. Army Command and General Staff College C/M/S 500 Fundamentals of Operational Warfighting" (Fort Leavenworth, Kansas: U.S. Command and General Staff College, 2001), L1-A-12.

⁹ General Rupert Smith, speech at The Kermit Roosevelt Lecture Series, British Army Staff Conference, Washington, DC, 28 September 2001.

CHAPTER 2

MONOGRAPH METHODOLOGY

Introduction

The thesis has been broken down into eight distinct parts, the first two parts of which introduce the topic, layout the methodology, and provide an understanding of the nature of the research undertaken. This monograph examines the modern operating environment, the forces in conflict, and their associated sources of power and support, in doing so it has to answer the primary question.

The Primary and Secondary Questions

This monograph answers the question: Is the current theoretical military operating environment a valid model for the twenty-first century? This broad question permits an analysis of the current operational environmental model, the theses that underlie its design, an examination of the possible future threat and environment, and thereby allows for the discussion of several models, which could be applied in the future. A diagrammatic representation of the monograph methodology is at Appendix A. Secondary questions form the basis of a chapter within this monograph. These questions have been further explained under the chapter number and title below.

Current Operational Environment Model—Chapter 3

The aim of this chapter is to define a baseline model for the monograph by examining the current state of analysis of the future operating environment in the US and UK. In order to do this, this chapter is broken into three parts.

By way of an introduction, the first part of this chapter highlights some of the changes inherent in the modern global system where the movement trend is away from the conventional thought of a linear, contiguous operating environment constrained by boundaries and held within

a geographic construct. This broadly sets the context in which studies have been undertaken by the subject nations. In essence, the initial part of this chapter will illustrate the direction in which common military thought is evolving and why it has been forced to evolve in that direction.

The second part summarizes the current military theoretical models for the operating environment from both the US and UK and where applicable highlights the changes in the direction of military thought after 11 September 2001. This part also includes an analysis of the suppositions that underlie the current model and a consideration of their continued relevance.

The third part of the chapter then examines current theoretical models that underpin operations conducted within the operating environments previously described in order to study the applicability of these theoretical concepts for future use and relevancy. The aim of this section is to outline any failures or shortfalls in current models, thereby allowing further research and development of a new theoretical model for the modern operating environment in later chapters.

The Modern Operating Environment--Chapter 4

This chapter essentially covers the resultant force and its arena of application, or put more succinctly, the force and its pressure. Chapter 4 is the synthesis chapter of the monograph, incorporating the ideas from its two main constituent parts into a working definition for the future operating environmental model. The two main sections of this chapter are in essence the constituent parts that make up the operating environment--the threat and its area of operations--the synthesis of which forms the conceptual basis for further theoretical model analysis in the subsequent chapter.

The Future Threat: The Force

As a method of construction, a threat is considered to be a directed *mass* driven by a *will* which when applied gives a resultant *force*. This model can be best understood if one considers the fact that the mass may manifest itself as an army in conventional thinking, or simply as one man operating as a terrorist activist; the will is the direction or support that he or they receive. In

keeping with the application of this Newtonian physics model, chapter 4 examines the physical and moral aspects of the emerging threat. As such, it is divided into three main parts.

Defining the Modern Operational Forces: The Mass of the Threat

Each military action or operation requires some sort of application of force. That force must be constructed of some form of mass. This chapter examines the type, form, and shape of probable future military or adversarial masses and their likely actions.

Defining the Modern Operational Will: The Acceleration of the Threat

As discussed in the preceding paragraph and in keeping with the classic idea that military action is an extension of political policy, this part of the chapter examines the “will” behind the application of force. In Clausewitzian terms, the will or passion comes from the people and is applied in a direction (giving a vector to the direction of the effect) by the reason of the government.¹ The amalgamation of the public passion with political direction in Newtonian terms is the acceleration behind the force.

Defining the Resultant Force: The Force of the Threat

In summary and as the final part of this chapter, the analysis done so far is brought together to provide a consolidated analysis of the future threat. In doing so this analysis provides the link into the next chapter, which considers the environment in which these forces may operate.

The Future Global Environment: The Fluid and the Friction

No force can act in a vacuum, at least in a political science model. To that end, this chapter examines the sources of geographical interest for the new operating environment. The intent is to consider the environment in terms of the threat and some of its sources of power, support, and possible locations for force application and training. The aim is to produce both a suggested geographical and non-geographical environment in which the threat defined in the

preceding chapter may operate. Using the parlance of the introduction, chapter 5 provides ideas for the environmental construct in which the theoretical masses float.

Global Shape

Initially, this chapter examines in broad terms, some of the aspects of globalization and the effects of those aspects on the shape of the world environment both physically and in terms of information.

Continuing with a more detailed analysis, this paragraph considers the likely internal arenas in which force could operate. Once again, both physical and non-physical areas will be examined. It is unlikely that future forces will be capable of operating solely within one nation, and that they will limit their operations or application of force to one particular nation. In that respect, this monograph considers the international environment in more detail.

Working Models--Chapter 5

Chapter 5 examines the applicability of the Newtonian Model used thus far and continues on to examine several other possible physical models.² The chapter introduces the ideas of general system theory, chaos and complexity into the standard Newtonian physics constructs.³ It is the aim at this stage to produce a working analytical model, which will assist in the design and application of modern military force within the newly defined environment or at least form the basis for further discussion and academic development as outlined in the concluding chapter.

Conclusions and Recommendations--Chapter 6

This final chapter, as the most-important part of the monograph, primarily highlights the findings of the thesis in the form of a summary. It also considers those problems raised within the paper that it has not been able to answer and which are therefore considered topics of further research, discussion or development. Chapter 6 suggests the doctrinal implications of this study

on the present body of research. Finally, it raises other important issues that require further research and that make recommendations for the direction that research should take.

¹ Clausewitz, *On War*, 89.

² Henry, W. Wyld, *Mathematical Methods for Physics: Lecture Notes and Supplements in Physics* (Massachusetts: Addison-Wesley Publishing, 1928). The work provided several mathematical models along with John F. Schmitt, "Command and (Out of) Control: The Military Implications of Complexity Theory" [Article on-line]; available from <http://www.ndu.edu/ndu/inss/books/complexity/ch09.html>; Internet; accessed 5 September 2001.

³ Ludwig von Bertalanffy, *General System Theory: Foundations, Development and Applications* (New York: George Braziller, 1968). See also Mitchell M. Waldrop, *Complexity: The Emerging Science at the Edge of Order and Chaos* (New York: Touchstone, 1992).

CHAPTER 3

CURRENT OPERATIONAL ENVIRONMENT MODELS

Change your opinions, keep to your principles; change your leaves, keep intact your roots.

Victor Hugo, *Thoughts*

Introduction

As the epigraph suggests, the changes made by governments to their force structure and method of force employment tend only to be superficial. General Rupert Smith commented on the fact that a future characteristic of modern warfare would be the need to fight new battles with old equipment (and perhaps fight old battles with new equipment).¹ Hugo illustrates the need to change and although, change itself will ensure the continuance of the foundation and strength of the system, it is true that change needs to be thorough enough and in line with the future, or perceived future needs. The problem with change within the military is that it is often difficult to remove predisposed ideas and structure, a fact that often ensures change is often not deep enough in order to guarantee survival of the system.

Western governments have acknowledged that there is a shift in the structure and nature of the modern operating environment; this acknowledgement has taken place since the end of the Cold War and has taken account of a majority of the issues currently on the global stage. This analysis by western nations has largely been conducted for purposes of force development in order to ensure the right force structure for the armies of the UK and US in the coming decades. What has not occurred in recent years is a rethinking of the theoretical methods of force employment that the current legacy organizations and forces of the future will have to employ.

To compound this issue, the development of new and contemporary operating environments has often been a cumbersome and slow process. The UK has not produced an unclassified up-to-date analysis of the operating environment since the events of 11 September.²

The operating environment has not simply been changing from the point of view of force structure. Changes in the nature of the global environment, methods of operation of corporations, governments, and independent actors have made the world a faster moving, higher tempo, and more inextricably linked arena.

In essence, the analysis of the military operating environment of the future has been conducted primarily from a force development (FD) standpoint without full consideration of force employment or doctrinal methodology. In some cases, the models used have already been overtaken by current events. This chapter examines the analysis undertaken by both the UK and the US in assessing the future operating environment and highlights some of the key findings. The aim is to establish a baseline of currently held opinion and to underline some of the shortfalls in theoretical analysis as far as force employment and doctrinal theory is concerned within the context of a future operational environment. This allows for further analysis of the current threat and modern operating environment later in the monograph.

Current Models

Background

As NATO member nations with a permanent seat on the United Nations (UN) Security Council, the US and the UK have attempted to develop a possible shape for the operating environment of the future in order to protect their interests and position internationally. Both the papers analyzed are born of, but are not direct descendants of, the need for nations to consider force structure changes following the breakup of the Soviet Union. The UK paper, in particular, is based amongst other things on a second-generation defense review known as the “*Strategic Defence Review* (SDR).”³ The US COE paper is also a descendant of initial reviews undertaken in the early 1990s.⁴ As such, neither paper is what one could consider a stand-alone analysis of the operating environment. Both concept papers have some roots firmly placed in the Cold War

era and are more importantly roots that have been affected by legacy equipment systems and commensurate ideas of employment.

The most-recent force structure review conducted by either nation is the US *Quadrennial Defense Review* (QDR). The report for this congressionally mandated review was released on 30 September 2001 and included reference to the events of 11 September throughout its text.⁵ Although a majority of the work summarized in the QDR Report was complete before 11 September 2001, the main themes of the paper aim to take the US down a new path of force development that are in line with those changes one would expect after the events in New York and Washington. The shift outlined is from a threat-based analysis to a capabilities-based force design paradigm, where instead of an analysis of a particular threat the new concept will now focus on the capabilities an adversary may bring into the fight. The report says, "This capabilities-based model focuses more on how an adversary might fight rather than specifically whom the adversary might be or where a war might occur."⁶ Commensurate with this change in development is a noted change in the methods of force employment, training, and operation, "The vast array of complex policy, operational and even constitutional issues concerning how we organize, prepare and defend the American people are now receiving attention."⁷ Of particular note from the QDR report are its acknowledgement of a changed global security environment, increased geopolitical trends, and the changing nature of threats around the world.

The report notes threats from both national and non-state actors focusing in the initial instance on Asia as an area of economic and military growth at the national level.⁸ Secondly, the report recognizes the existence of terrorism, crime, and other asymmetric threats as a danger to national security.⁹ The QDR report provides a solid base from which to develop new doctrine, force structures methods of force operation in light of capabilities based analysis coupled with new theoretical operational models.

It is interesting that the UK paper on which a majority of the initial part of this chapter's research is based takes a great deal of its information from the US Army's own analysis of the future operating environment; in doing so, it ensures the relevance of this monograph's analysis of the thinking of the two nations considered together.¹⁰ Not only does the work ensure constituency amongst some primary NATO members, but it reinforces the assumption of this paper that the threats to western nation-states are common in nature, and can therefore be analyzed together.

In order to give this baseline analysis a structure, the outline followed in the UK paper will be used. This layout is an extraction of the Defence Evaluation and Research Agency, (DERA) "Project Insight Study," which informed the "Evolution of Warfare" (EOW) study for the UK; a project which was put on hold at the start of the SDR process but was continued on the completion of that defense review.¹¹

Scope and Features of the Analysis

Both papers have taken input from external and military sources and extrapolated trends and constants from previous studies. The UK document relies upon information from several external, non-military sources including the "Millennium Project Report of the American Council for the United Nations University for 1997" and the "Millennium Project Report of the American Council for the United Nations University for 1998".¹² An extract of the key issues from the "Millennium Project Report of the American Council for the United Nations University for 1998," forms a backdrop to the changing global environment discussed in the British paper.

Both the UK and US papers take a great deal of their analysis from current and emerging military thought. The UK paper is structured along the lines of an environmental analysis conducted by DERA and takes information from the SDR analysis and other contemporary works from within the UK system. Another substantial contributor of information and analysis is the US military; a sizable section of the UK FOE paper is given over to an analysis of the US

operational perspective and commensurate US studies and reports. Although no footnotes and references have been included in the US version of the FOE, it is clear that similar non-military strategic analysis and conventional military thought has been included in its production.

No background review of the underlying models in this monograph would be complete without some mention of the measure of uncertainty or risk acknowledged by two authors of the subject papers. The results of the "McKinsey Strategic Theory Initiative," provide the basis against which the UK considers uncertainty and strategic posture.¹³ The article used by the UK from the *McKinsey Quarterly* has been rewritten more recently and contains some interesting models that will be explored later in this paper.¹⁴ That having been said, the original document of 1996 referenced in the UK paper provides a model which considers four levels of uncertainty and three possible strategic positions that can be taken by planners.

Table 1 contains a brief summary and description of each level of uncertainty, and table 2 is a summary of the idea behind *strategic posture* from the current 2000 paper.¹⁵

Table 1. Summary of McKinsey Uncertainty Levels

Level of Uncertainty	Brief Description	Planning Tools
(a)	(b)	(c)
1	The lowest level of uncertainty, where one assumes that the traditional models still hold true. It should be noted that uncertainty has not been removed; simply that analysis is sufficient to overcome the possible effects of uncertainty.	Traditional frameworks still apply
2	Where uncertainty is great enough for several possible scenarios to be run although which one the future will follow is unknown.	Scenario planning and quantitative game theory should be used
3	A great level of uncertainty where the future can follow one of several paths and manifest itself in different ways along each of the paths.	Planners need to produce qualitative developing models to deal with this scenario
4	True ambiguity.	As level 3

Source: Kevin P. Coyne and Somu Subramaniam, "Bringing Discipline to Strategy" *The McKinsey Quarterly*, no. 3, (October 2000): 61-70, 65.¹⁶

Table 2. Summary of McKinsey Strategic Positions

Position Title	Brief Description
(a)	(b)
Adapting	Considered to be the most common method employed by large firms and corporations. In this scenario, the organization attempts to predict the future and adapts to meet it.
Shaping	Opposite in nature to adapting, shaping is an attempt to affect the environment to meet one's own needs. It can be argued that this methodology is best used at greater levels of uncertainty, it does carry the largest rewards but also, the highest level of risk.
Reserving the Right to Play	The most passive of the possible options. This strategy involves doing as little as possible in order to keep open other possibilities.

Source: Kevin P. Coyne and Somu Subramaniam, "Bringing Discipline to Strategy" *The McKinsey Quarterly*, no. 3, (October 2000): 61-70, 66.¹⁷

One important caveat to uncertainty and the forecasting of futures both the UK and US papers note is that the further one extrapolates an idea in time or attempts to predict future situations the greater the error becomes. The UK FOE paper notes:

Although studies of the period 2015 might reasonably be pitched between Levels 2 and 3 of the McKinsey typology, the 30-year time frame of both future defence planning and FOE must be pitched more towards Level 4 – true ambiguity.¹⁸

The same theory could be applied to operational planning, an arena in which the level of uncertainty is high because of the plethora of variables. This monograph will examine in a later chapter the applicability of McKinsey's levels of uncertainty and strategic positions in operational planning.

Although broader in nature, the Directorate General Development and Doctrine (DGD&D) paper provides an outline in almost list format of the possible actors present in and around a modern operating environment; this is understandable considering the fact that the aim of the paper was to inform the force development process. Whereas the US paper is more prescriptive in its description of the global operating environment, it does provide a better tool for

doctrinal planning and analysis. In its summary of the effects on uncertainty, the UK model makes the assumption that, "future conflict will be between well-equipped, technologically developed opponents;" this assumption is examined later in this thesis.¹⁹

The Changing Environment

In order to highlight some of the major points in each paper, this monograph has used the subject-heading format of the main section of the UK FOE paper.

Economic Globalization

Economic globalization and in fact globalization as a whole is seen by both nations as the major driver behind worldwide change. The very nature of globalization adds to the complexity and opportunities available to opponents. DGD&D notes four key concerns related to economic globalization, of these and particularly relevant to the operating environment and future threats is the fact that globalization "is an imperfect process of economic integration [and] is capable of unleashing strong disintegrating processes in time of recession." It goes on to note, "the processes underlying globalization favour the developed nation--particularly the UK and US."²⁰ The US Army's Training and Doctrine Command (TRADOC) considers that:

Globalization will demand international interaction on a wide range of issues affecting states, regions and the global environment. This will create friction as cultures, religions, governments and economies network and collide in a highly competitive global setting.²¹

The impact of economic globalization on the global operating environment is that an "increasing interdependence of nations and a lack of [effective] regulatory mechanisms, means that regional economic crises will be difficult to contain and may rapidly develop a global impact."²² Globalization may also increase instability as it widens the gap between developed and developing nations. This effect has a direct impact on the armed forces of the US and UK. Amongst some of the things seen as necessities within future force structures and for strategic preparedness are rapid deployment forces, balanced and as accurate as possible view of the future, and training opportunities with "coalitions of the willing."

Demography

The pressures related to an increasing world population have the potential to lead to global instability. The effect of spiraling growth rates is not simply one of increased competition for fewer resources; it is one where population masses will be unevenly distributed across the globe and particularly between developed and developing nations. Migration and an increasing demand on sparse resources are possible points of friction. However, this phenomenon is not just a transnational problem. Increasing disparity within national boundaries can be seen between urban and rural areas. The UK paper feels that, "Cities in the developing world will be ever more closely identified with poverty and social collapse."²³ Overall, the effect of negative demographic factors on globalization will probably be destabilizing. However, what may be more interesting is the possible effect of perceived relative deprivation (PRD) and the possibility of conflict arising from this alone.

Another outcome of this phenomenon may prove to be increased pressure from international bodies for intervention in humanitarian missions to counter demographic related problems perhaps, fueled by media pressure.

All these problems add to the complexity of future operations. Problems range from issues of operability within coalitions, increased difficulty of operational terrain in urban areas, to the rise of asymmetrical threat from the proliferation of knowledge through demographic migration which has occurred in order to meet the requirement for a larger immigrant workforce.²⁴ These issues can all lead to points of friction and conflict.

Environmental Change

Coupling an increase in population with an almost paradoxical decrease in resource availability and environmental degradation has exacerbated environmental change. International efforts to stabilize and restore much-needed water supplies in certain areas may not be sufficient

to ward off an international crisis. Both papers consider direct threats within this arena to be aimed at national assets and UK and US citizen abroad.

Science, Technology and the Access to Knowledge

This area can be broken into three parts.

Knowledge

Technological development when merged with increased globalization and the interlinking of nations and organizations has meant that there is a perceived transition from the industrial to the informational age.²⁵ This increased level of technological capability coupled with increased knowledge access and availability due to globalization has led to an increased role for knowledge itself. Knowledge is now considered an asset and as such, can be sold or moved meaning that as a commodity it is equally available to the weak and strong in the future.

Availability

The increase in the rate of change of technological capability has led to companies and even militaries to rely on commercial off-the-shelf purchases. It is no longer possible to maintain a technological advantage by “in-house” development, as such. Advanced technology is now available to all who can afford to pay for it. Abundantly available technology means that there is the possibility of an increase in the asymmetrical threat; this fact coupled with the real danger of weapons of mass destruction (WMD) proliferation leads to a very dangerous and threatening scenario. Not only will WMD be a national tool, but also there is increasing concern that non-state actors will eventually be capable of harnessing and even employing a WMD capability.²⁶

Methods of Employment

Two key considerations fall from this.

1. Technological development has itself fed on globalization. As communications have improved, so has the passage of information which has in turn increased the rate of improvement

in technology. As for the impact on the operating environment, the UK and US both see the battle of information as the key to future operations. Although it should be noted that knowledge is not a panacea, its control, exploitation, and application will be key parts to any future campaign.²⁷

2. Future opponents will protect the technology they have accrued because of the cost and difficulty on acquiring it. This may change the nature of future operations to the point where opponents will avoid direct confrontation. Furthermore, it is possible that they will employ asymmetric means against national strengths and attempt to mitigate the technological advantages of the US and UK with niche or non-technological means.²⁸

The Coherence of Politics

Perhaps the biggest threat to the coherence of politics is the perceived irrelevance of the nation-state caused by the dilution of nation-state effects brought on by globalization.²⁹ The DGD&G view has been distilled into four key concerns:

1. The unwillingness of rogue states to abide by international law
2. An increase in national and international organized crime
3. An increasingly sophisticated threat posed by state-sponsored and issued based terrorism
4. The ease with which minorities within one nation can communicate with sympathizers in another nation--a phenomenon known as Diaspora

The main concern of these factors on the future operating environment is typified by a breakdown of governmental control and the impact rogue nations and organized crime can have on weak, non-threat developing nations thereby causing instability or challenging the UK and US strategic position.

Public Perceptions and Attitudes

Because the media now has an increased role in shaping public perception, both the UK and US have noted the importance of attaining and maintaining legitimacy from both a national and international standpoint. With increasingly complex humanitarian and international operations, military illiteracy (a declining public understanding of the actions of the armed forces) may play a greater part in the gaining of and maintaining of, national support.

In short, it will become increasingly difficult to raise national support for issues outside national security. Another destabilizing factor is perhaps the fact that “religious fundamentalism will fuel increasing sources of instability ... with scant regard for international law and the constraint of international boundaries,” raising national sympathy against certain operations thereby causing internal strife and lack of support for operations abroad.³⁰

The US Dual Strategic Position

Having considered both the TRADOC and DGD&D papers using the format of the UK paper, it would be amiss not to mention the two US-derived effects that a threat could employ against the US. Discussed in the TRADOC paper, these two positions can only be considered viable when US force projection is required.

Strategic Preclusion

As the US and other coalition partners attempt to shape the international environment in order to produce a favorable operational situation during a crisis, so will one's opponents. Strategic preclusion is seen as an attempt by aggressor actor or their adversaries to preclude US involvement in an international situation.³¹ These actions can either be based on passive deterrence, the threat of weapons of mass destruction (WMD) for instance, or active deterrence where either the activities abroad are kept to a minimum level in order to ensure that the threshold of US involvement is not reached or where external international pressure prevent the gathering of international support and legitimacy.

Operational Exclusion

Linked closely to strategic preclusion, operational exclusion sees the denial of operational bases in the region in question to US forces.³² Using an operational exclusion policy, aggressor nations are expected to employ many lines of operation to ensure the regional denial of operational assets to the US. These means could include diplomatic, economic, passive, and active threats towards countries in the region.

Summary

In summary, table 3 is an analysis of possible military missions in comparison to the views of the US and UK in relation to their analysis of the modern operating environment.³³ The table is an adaptation of one used in the British paper that compared two environmental assessments.

Table 3. A Comparison of the UK and US Analysis of Operating Environments by Possible Mission Type

Ser	Mission Type	UK Assessment	US Assessment
(a)	(b)	(c)	(d)
1	Security of National Citizens in peace	Asymmetric threat increasing as a risk of the exporting of violence to UK thorough terrorism, desire for media impact and demographic migration	Asymmetric threats increasing. Niche technology and WMD threat
2	Security of dependent territories	Threat remains the same as cold war era	Niche technology threat
3	Defense diplomacy	Requirement increasing	Requirement increasing
4	Defense support to wider national interests	Requirement increasing	Requirement increasing coupled with a niche technology threat
5	Peace support and humanitarian ops	Requirement increasing	Requirement increasing coupled with a niche technology threat
6	Regional conflict inside NATO	Threat increasing. Asymmetric threat increasing including WMD	Asymmetric threat increasing including WMD
7	Regional conflict outside NATO	Threat increasing	Not noted although, analysis considers full spectrum operations as remaining likely
8	Strategic attack on NATO	Reduced threat remains. Unlikely for at least 10 years. Economic globalization is the key driver for change	Not noted

The scope of military missions in table 3 has been broadened in order to encompass both UK and US possible missions under generically termed military actions.

Future Enemy

Both papers, although primarily the TRADOC FOE paper, note the uncertain nature and structure of the future opponent. In a detailed threat paragraph TRADOC has outlined the possible means that could be employed by an aggressor and the methods, at least in principle, they would employ.³⁴ Each nation sees the future threat as having the possibility of conducting high-intensity operations (although unlikely at this juncture) but mixed with a low-intensity, asymmetrical, and asynchronous nature. Information and technological means of war fighting are key force development drivers for both the US and UK.

Following the events of 11 September 2001, TRADOC DCSINT wrote a draft paper outlining the nature of the terrorist attacks and a possible framework within which non-state actors of the sort that conducted the attacks would operate.³⁵ Tying in closely with the TRADOC FOE paper, the draft paper makes special note of transnational actors who reside and train in one nation but gain support and resources from another. In conclusion, it notes that acts of terrorism are, "part of every future opponent's strategy and will be part of force design and capabilities."³⁶

Future Environment

Both papers have acknowledged that the impact of globalization on not just the economy but on almost every area of development and relations is the largest and most important driver of change. TRADOC has noted that the future terrain will be more complex, and more often than not, of the opponent's (not one's own) choosing. This complexity, coupled with an asynchronous environment, will aim to keep the US "off balance" and prevent the massing of system effects that are often employed by the USA and other national armies.

Future Doctrine

Although only briefly discussed in the TRADOC paper, the future of doctrine is encapsulated in the terminology used in FM 3-0.³⁷ The TRADOC paper notes that future force employment will be done along shaping, supporting, and decisive operational lines. The UK paper notes that operational tempo will be important for the employment of future forces, and that multinational operations will need multinational doctrine.

Summary of Theory Shortfalls

Both nations have developed their new operating environment analysis based on several continuing paradigms and models. Each has noted the importance of technology in attaining the initiative, but noted the vulnerability of this tool when facing niche or low-technological means.

Although the shaping of the environment has been alluded to in the UK FOE paper and by TRADOC, there has been no analysis of the impact of the future operating environment on military thought, doctrinal employment, or the relevance of contemporary thought.³⁸

It seems on the surface that the traditional linear theories of Clausewitz and Jomini remain in place for the employment of Western forces. There has been a great deal of work done on both sides of the Atlantic in an attempt to quantify and reduce the uncertainty in the future operating environment, but it seems, however, that the UK and US militaries are taking a more *adapting* course at the operational level as opposed to a employing a *shaping* methodology.

In short, it seems that the two nations analyzed have projected into the future and attempted to take into account the possible changes in the operating environment but have stopped short in their analysis. Neither has addressed the implications of such changes with regard to the best method of attacking the enemy within the environment in which he will operate. The UK and USA seem to be restrained, and understandably so, in their thought processes by four main factors: (1) technological capability, (2) legacy equipment, (3) state structure and constitutional conditions, and (4) current doctrine.

This monograph continues to examine the changing operational environment and threat from a shaping strategy point of view. Strategies of adapting seem to lead to change, but only in certain areas, strategies of shaping may lead to fundamental new doctrinal theories which can be employed in the future operational environment.

¹ General Rupert Smith, speech at The Kermit Roosevelt Lecture Series, British Army Staff Conference, Washington D.C., 28 September 2001.

² No evaluation of the military operating environment was available for analysis at this stage in a unclassified format. As such, it is fair to say, the UK has not attempted to change the theoretical construct on which operations are and will be conducted.

³ British Government, *Strategic Defence Review* (London: The Stationery Office, 1998). Followed from the earlier "Options for Change" which drew down the UK Armed Forces directly after the fall of the Soviet Union.

⁴ U.S. Army, TRADOC/DCSINT, "The Future Operating Environment" (Draft paper, Fort Leavenworth, Kansas, TRADOC, May 2001).

⁵ U.S. Department of Defense, *The Quadrennial Defense Review Report* (Washington, DC: Department of Defense, September 2001), iii.

⁶ Ibid.

⁷ Ibid., v.

⁸ Ibid., 3.

⁹ Ibid., 7.

¹⁰ British Army, Directorate General Development and Doctrine, "The Future Operational Environment: Implications for Future Army Force Development" (Development Paper, Upavon, United Kingdom: Directorate General Development and Doctrine, January 2000), 8.

¹¹ DERA incorporates the bulk of UK MOD non-nuclear research, technology, testing, and development assets.

¹² American Council for the University of the United Nations "State of the Future: Issues and Opportunities" [report online], ed. Jerome C. Glenn and Theodore J. Gordon, available at <http://www.geocities.com/~acunu/millennium/sof/issues.html#2.1>; Internet; accessed 21 November 2001.

¹³ DGD&D "FOE," 12.

¹⁴ Kevin P. Coyne and Somu Subramaniam, "Bringing Discipline to Strategy" *The McKinsey Quarterly*, no. 3, (October 2000): 61-70.

¹⁵ Because the original article was written using corporate terminology, some of the findings have been adapted to meet contemporary political and military verbiage.

¹⁶ Coyne and Subramaniam., 65.

¹⁷ Ibid., 66.

¹⁸ DGD&D "FOE," 12.

¹⁹ Ibid., 11.

²⁰ Ibid., 13.

²¹ TRADOC "FOE," 1.

²² DGD&D "FOE," 14.

²³ Ibid., 16.

²⁴ Ibid., 17.

²⁵ Toffler and Toffler, *War and Anti-War*, 20

²⁶ DGD&D "FOE," 19.

²⁷ Ibid., 21. It should be noted that the UK paper expands on the issue of information operations as a possible indicator of a RMA, which although not considered relevant to this paper, is related to the FD concept of the UK paper.

²⁸ TRADOC "FOE," 2.

²⁹ DGD&D "FOE," 23.

³⁰ Ibid., 27.

³¹ TRADOC "FOE," 2.

³² Ibid., 3.

³³ DGD&D "FOE," 28.

³⁴ TRADOC "FOE," 5.

³⁵ US Army, TRADOC/DCSINT, "The Attack on America and The Implications of The Future Operating Environment: The first War of the 21st Century" (Draft Paper, Fort Leavenworth, Kansas: September 2001), 1.

³⁶ Ibid., 7.

³⁷ TRADOC "FOE," 6.

³⁸ DGD&D "FOE," 12.

CHAPTER 4

THE FUTURE OPERATIONAL ENVIRONMENT

He who fears not death fears not a threat.

Corneille, *The Count, in The Cid*

Introduction

This paper has so far summarized the operational environmental analysis of the UK and US militaries in real terms. In other words, the analysis conducted so far has focused on fact and expected situations, arguably from a probability based standpoint, not on a theoretical understanding of operational environments and force employment issues. In order to enable a more-comprehensive analysis of the modern operating environment in terms of theory, this paper now analyzes the future threat and the global environment melding the two into a construct for the future operating environment in theoretical terms. The chapter is broken into three parts: the first two of which consider future threats and environments, respectively, and the final section melds these considerations into a plausible working framework which allows for the development of a theoretical model in the next chapter.

General Construct of Threats

In its basic form, there are only two types of potential threat, national and non-national forces, or non-state actors. Traditionally, the military forces of nations have and continue to provide security for their nation and her allies. Non-state actors are those non-governmental organizations that act either internally within a nation or across international borders. As the preceding chapter explained, the rise of non-state actors to the fore in the last twenty years is not unexpected, but the rate of change has been. The CIA global projection paper "Global Trends to 2015" noted in its introduction to the paper that the organization's last forecast paper, "Global

Trends to 2010," missed several key issues in its forecasting, one of which was the speed of weapon and technological proliferation adding to the ascendancy of non-state actors.¹

Nation-State Threats

Before moving on to the non-state actors, it is perhaps prudent to examine the one organization that has shaped the doctrine and structure of Western (and indeed global) society since 1648, the nation-state. Many people and organizations have noted recent global changes in the relationship of nation-states. Martin van Creveld notes in his 1991 book, *The Transformation of War*, that the old models of Clausewitzian Trinitarian warfare are for the most part obsolete.² Van Creveld argues that nation versus nation conflict will not be waged in the future; he states that there will be an increase in low-intensity conflict between "ethnic and religious groups," which makes the theories and methodology of the past obsolete.³ This statement, although questioned in the ensuing 1991 Operation Desert Storm, is probably largely correct when examined in light of today's political climate. However, it should not be forgotten that there are national level threats around the world which continue to develop both conventional and non-conventional arsenals.⁴ There may be perhaps less chance of a nation-against-nation threat, than a nation versus failed-nation threat where the instability in one nation forces action against another. "Global Trends to 2015," states:

The changing dynamics of state power will combine with other forces to affect the risk of conflict in various regions. Changing military capabilities will be prominent among the factors that determine the risk of war. In South Africa for example, that risk will remain fairly high over the next 15 years. India and Pakistan are both prone to miscalculation. Both will continue to build up their nuclear and missile forces.⁵

The paper continues to list other potential areas around the world where the conventional application of force is not without the realms of possibility. It seems that the potential remains, at least in some areas of the world for inter-nation conflict. This fact has not gone unnoticed by the US military intelligence community. In his congressional testimony to the Senate Armed Service Committee on 8 March 2001, Vice Admiral Thomas R. Wilson, the Director of the Defense

Intelligence Agency (DIA), noted the potential danger of conventional conflict as a near-term concern.⁶

It is therefore not only acceptable; it is also prudent for this paper to maintain a conventional model capability within the assessment of the modern operating environment. It seems that the possibility of and actual manifestation of inter-state conflict has changed dramatically in recent years. However, the difficulty in analyzing the global threat system lies in its complexity, diversity, and interconnected nature. Nation-states form a small part of the overall operational threat picture, and the true difficulty comes with quantifying the remaining structures and non-state actors.

Non-state Actors

One of the most contemporary books in recent years looking at threat and methods of threat attack in military terms is *Unrestricted Warfare* by Qiao Laing and Wang Xiangsui, both senior colonels in the Chinese military.⁷ The book, written in China and published by the Peoples Liberation Army (PLA), is an in-depth analysis of the modern arena of conflict which argues amongst other things that the operational environment is not the sole province of the military any more. For the purposes of this thesis, the concise article by Lieutenant Colonel Bill Flynt, US Army for the US Army *Military Review* in July 2000, "Threat Kingdom," provides a detailed and accurate synopsis of the key threat actors contained in the PLA book.⁸ Flynt explains the methods used in analyzing *Unrestricted Warfare* and has extracted fourteen threats, means, targets, and probable ends from the book. The extracted and reformatted table containing the list of threats is in table 4.

Table 4. Emerging Threats, Means, Targets and Ends

Threats	Means	Targets	Ends
Autonomous Terrorist Organizations	Assassination	Banking and Finance	Asymmetric Conflict
Cult	Biological Agent	Biological Research/Production/Storage Installation	Contain the United States
Economic Warfare team	Bomb	Business	Economic Advantage
Fringe Group	Chemical Agent	Chemical Research/Production/Storage Installation	Expand Power
Hacker	Cyber-strike	Continuity of Government	Financial Gain
Information Warfare Team	Direct action	Diplomatic Target	Hate
Lone Wolf	Espionage	Electric Power System	Ideology
Paramilitary Group	Extortion	Emergency Service System	Metaphysical
Spy	Hoax	Water Supply	National security advantage
State Sponsored Terrorism	Information Operation	Government Installation	Political Change
Traitor	Nuclear Weapon	Law Enforcement	Political Influence
Transnational Criminal Organization	Radiological Agent	Military Installation	Revenge
State	Economic Attack	Nuclear Research/Production/Storage Installation	Survival
Transnational Actor	Genetic Agent	Oil and Gas system	Vandalism
		US Population	Obtain WMD
		Public Health System	
		Telecommunication/Information System	
		Transportation System	

Source: LTC Bill Flynt, U.S. Army, "Threat Kingdom," U.S. Army Military Review, USACGSC, vol LXXX, no 4 (Jul/Aug 2000), 17. ⁹

Table 4 illustrates a myriad of combinations of threats, methods, and ends. However, for the purposes of this paper, suffice it to say, the possible number of combinations of threat, ways and means towards an end shown in the table is enormous thereby making the operational climate

incredibly broad and difficult to comprehend fully. Flynt's thesis continues on to consider a grouping of threats into a class or phylum, which he calls, "a threat kingdom actor."¹⁰ This idea is analogous to the concept of the national superpower or great power. He argues, where as "norms or political institutions may limit superpowers and great-powers," the threat kingdom actor is not limited in such a manner.¹¹ Flynt defines a threat kingdom actor as "The most dangerous potential opponent, able to engage across the entire conflict spectrum in time, space, intensity and instruments of power, including strategies of asymmetry and anonymity."¹²

Clearly there are a myriad of combinations of threats, ways, and means which can be employed in order to strive toward a defined end. Flynt analysis of the Laing-Xiangsui paper further distills the most mentioned of the four headings contained in table 4. These are shown below in table 5.

Table 5. Emphasized Threat, Means, Targets and Ends

Threats	Means	Targets	Ends
Autonomous Terrorist Organizations	Bombing	Critical Infrastructure	National security advantage
Information Warfare Team	Information Operation	Business	Economic Advantage
State	Economic Attack	Population	Financial Gain
Hacker	Cyber-strike	Banking and Finance	Political Influence
State Sponsored Terrorism	Direct action	Critical Infrastructure	Political Change

In the examples outlined in table 5, each row shows, in theory at least, the most likely combination of threats, means, targets, and finally the potential ends. Using this form of analysis, nations might begin to understand the organizations they are facing, and possible actions thereof, thereby allowing the nation the opportunity to deal with the situation. The point to be taken away from this in the context of this paper is that there is a multiplicity of threat ways, means, and

targets is indicative of the complexity of possible permutations of actor, means, and methods, which changes the face of the operational environment more dramatically than first imagined.

Future threats will now employ new means, and as Flynt shows, information and cyber-attacks are clearly within the realm of possibility. To that end, one can deduce the fact that if an actor can apply information or disinformation against another and cause an effect, then theoretically information has mass.

Defining the Modern Operational Forces: The Mass of the Threat

In assessing the information in Flynt's paper, it seems each list category can be placed that into a series of sub-groups in order to assist in the development of a theoretical model. When looking at threats in the first instance, it is clear that they can be grouped into individual or collective organizations. On the surface, this seems a superfluous thing to do, but it is important for the defining of the vector, or direction of will, with which the mass of the threat is applied. Collective organizations, such as states and corporations, are more likely to aim toward similar goals as opposed to an individual, following a campaign of vandalism. This grouping also provides a framework with which to examine the theoretical model for the future operating environment.

The application of a mass or body against another adversary is inherently different from the application of mass during the Napoleonic period. Today, mass can manifest itself in several forms and can be increased in effect with the application of different weapons systems, that is, quality can effectively speaking, add to the quantitative effect of a mass. With the proliferation of science and technology, mass is no longer the province of the physical ideal. Moreover, the theory of *mass* can be applied in the virtual world as well. The development of this theory allows for the consideration of mass in either environment.

Physical Mass

Physical mass is perhaps the best understood, not least because it can be seen, felt, and more easily quantified within current doctrinal constructs, thoughts, and models. Physical mass is, as the term suggests, the physical application of means against an opponent. Actors can apply physical mass against another physical mass, but not against a virtual target (such as a personal thought or information) or used in a virtual environment. It is for instance possible to strike an opponents infrastructure with physical means, but it is not possible to attack his information or psyche directly with a physical implement. The physical implementation can manifest itself in various forms as shown in table 4, but there is a subtle difference between each possible means and the methods employed which increase the severity or force of the attack. For instance, the effect achieved by a terrorist using a small incendiary device in a populated area is less than that achieved if he were to use a WMD.

The National Intelligence Center paper "Global Trends to 2015," amongst many other similar publications, argues that the proliferation of science and technology have increased the danger of weapons of a greater mass being available to a wider threat base.¹³ What is important at the theoretical level in this conclusion is that it is easier for the non-state actor to achieve a greater effect with greater force but using less effort. Therefore, the quality-quantity paradox highlighted earlier in this chapter is also an advantage to the non-state actor.

Virtual Mass

A second type of mass is virtual mass. Information and disinformation are perhaps the clearest examples of virtual mass. Virtual mass is much less tangible than physical mass and is more difficult to quantify. If one follows the Newtonian theory of force being a product of mass and acceleration (will), it would be very difficult to quantify the amount of force an opponent could bring to bear in terms of virtual mass, in current terms at least. Although new in concept,

the application of virtual mass leading to either physical or virtual pressure is nothing new at all. The application of force by lobbying or media pressure is another form of the use of virtual mass.

Mass can now be considered in two forms, physical and virtual; however, as this chapter later shows there are restrictions on the application of mass in different environments. Physical mass is confined to the physical world, where as virtual mass can be applied in either the physical or virtual realm.

Defining the Modern Operational Will: The Acceleration of the Threat

For a mass to be applied to achieve an effect, there must be some form of acceleration behind the mass, and this would normally manifest itself as some form of intent or will. Following the construct of collective and individual threats, it is safe to say that there are collective and individual wills which drive the mass forward. There are of course subcomponents of each form of will that do not fall into one category alone. Clearly, a will driven by idealistic theology can either be a mechanism of the collective or individual organizations. Will is perhaps the area that has changed the least over the years since the formation of the nation-state. The final point in the consideration of will is that each type of will carries its own strength or momentum; indeed, it also adds a vector to the ensuing force. It should be noted that the application of certain wills could produce a greater or lesser force than the application of another.

Analyzing the rationale for following objectives is beyond the scope of this paper; but without pursuing a theological argument, suffice it to say that it is the will that gives the mass its subjective directions towards applying the force.

Defining the Resultant Force: The Force of the Threat

In essence, the resultant force (F) comes from the application of either physical (p) or virtual (v) mass (M) driven by either a collective (c) or individual (i) will (A). Putting this into the context of today's operating environment one can see that a threat can apply a force which consists of either a physical or virtual mass, Mp or Mv propelled by either a collective or

individual will A_c or A_i . This in turn would give a resultant force in four forms, F_{pc} , F_{vc} , F_{pi} , or F_{vi} .

Table 6 therefore gives some idea of the possible distribution of mass. If the threat from one's opponent is of a virtual nature then it is safe to assume that a propensity of his mass will be of a virtual nature also.

Table 6. Summary of Resultant Theoretical Forces

Mass	Will	Force
Physical	Collective	M_{pc}
Virtual	Collective	M_{vc}
Physical	Individual	M_{pi}
Virtual	Individual	M_{vi}

The Future Global Environment

Global Shape

The UN University's "Global Challenges for Humanity," is a UN millennium Summit and Forum special edition paper published in September 2000. It lists fifteen plausible and quantifiable challenges to peace, prosperity, social, and economic development. Of the fifteen areas described in the document, five relate directly to military operations or potential operations. The paper relates a further three to the military indirectly, and the remaining seven have some partial link to the military. Understanding this point is particularly important for understanding the context of future military operations. Nations no longer raise armies for purely national defense and the furthering of national interests; they have a broader and more complex role within the international arena. Moreover, over one-half of the global concerns listed in the paper have military implications for one or more nations. The basic premise of this paper is that the

future operating environment will be pan-global. There will be no boundaries that can easily be described as operational, tactical, or strategic.¹⁴ As David Wood describes in his article in the *Navy Times*, "National Security After the Cold War: Boundaries Once Clear now in Chaos," the threats the nations face are now global, linked, and transcendent of national boundaries.¹⁵

Physical Environment

The nation-state by its very definition and geographical structure exists firmly within a physical world. It normally exhibits a hierarchical structure at least within the government and political-military structures and is often bound by doctrine and law. One can consider inter-state conflict, at least in terms of this paper, as the more simplistic form of engagement. The rules governing them are well known; their doctrine and capability is also well understood, which leads, in times in conflict to a structured, Newtonian application of force. In this case the modern physical and operational construct remains constant for nation-upon-nation conflict.

If one were to draw the interrelation of strategic, operational and tactical spheres during conflict, it would look something like figure 1.

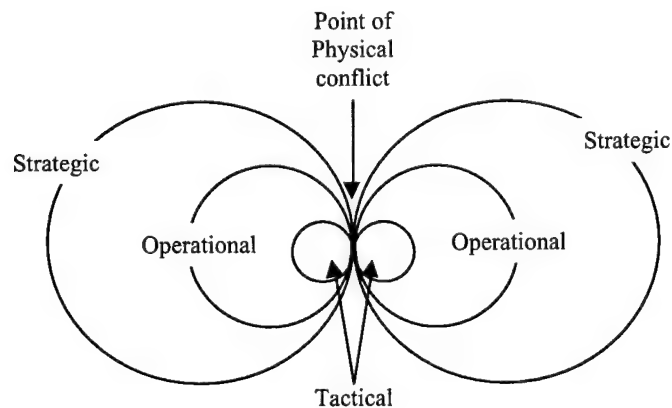


Figure 1. Current Levels of War in the Physical Environment

The actual point or points of conflict manifest themselves in the physical environment at the tactical level. Although operational and strategic levels of war may touch or even overlap, the contemporary theoretical model still sees the application of force at the tactical level. The remaining two levels of war merely shape one's opponent; decisive action is executed at the lowest level. This assumption is clearly no longer the case. Not only does one now have to contend with an increasingly complex and interlinked physical environment, one also needs to consider a virtual dimension to the operational environment. The strategic, operational, and tactical levels of warfare have now merged and continue to coexist as networks that continue to cross national and virtual boundaries.¹⁶ This may indicate that it would be better to view the operational levels of war in terms of functional alignment instead of a hierarchical structure.

Networks

There are clearly other forms of structure that need to be considered when examining the possible manifestation and environment of the future threat. Organizations also exhibit network-like structure, which comes in three basic forms shown in figure 2.

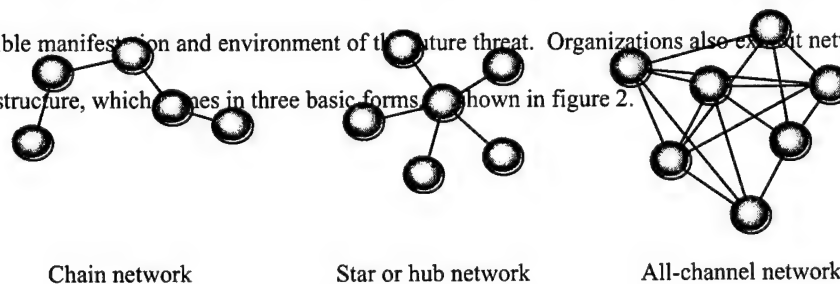


Figure 2. Types of Networks.

Source: John Arquilla and David Ronfeldt, *Networks and Netwars: The Future of Terror, Crime and Militancy* (California: RAND Organization, 2001), 8.¹⁷

This increase in networking has only been aided by the recent escalation in globalization. All forms of networking have been established and improved to a point that has gone beyond previous expectation.¹⁸ Networking alone does not provide a problem to a nation-state; indeed, the advances in communications and economic linkages have been exploited by nations and corporations alike.¹⁹ The problem arises when network organizations threaten nation-states. The network is the modern analog of the echelon structure that hierarchal formations with which nations are familiar. The crux of the dilemma for the nation-state is that the primarily hierarchical, linear structure of its military (in particular the command and control structure) can never be comfortably placed upon that of a network. The network can always move to avoid suppression, adapt to keep its distance from the linear, more rigid hierarchical entity.

Figure 3 is a diagrammatic representation of an all-channel network dispersed across several nation-states.

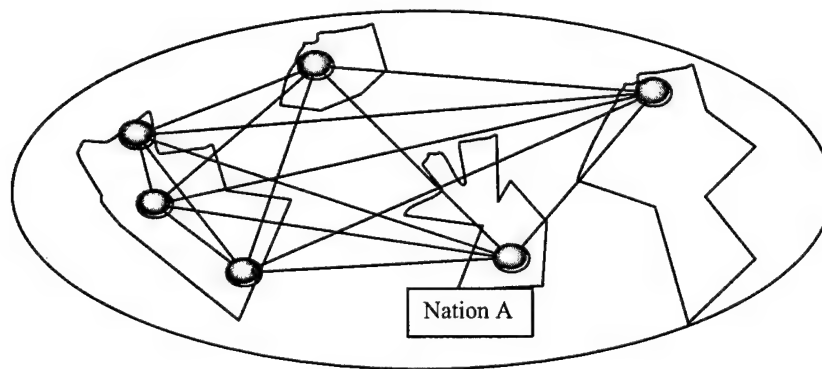


Figure 3. Transnational Networks

It is clear that the construct of the nation-state cannot contain a network in real terms when the network itself spreads outside national boundaries. Nation A cannot contain or act against a network that acts through or is physically based within another nation without the

assistance of that nation or without stepping outside the constraints of political agreements and international policies. This dispersed state is difficult to overcome where surrounding nations employ strategic preclusion or operational exclusion limits action in both the virtual or physical environment making the containment and action against such an organization more difficult. It also means that a network can strike at any level of war at any time in both the physical and virtual realm.

Virtual Environment

The network provides the construct for the virtual environment. The virtual environment is a non-physical arena where either an individual or organization can take action in order to achieve effects similar to those possible in the physical world. Clearly the tools are different as the manifestation of mass would be in the form of information and electrons pressure will be applied in a more-surreptitious multidimensional way.

If there is a will driving the force conceptually then in the case of both the physical and virtual environments there must also be a directional aspect to will. Essentially one must remember that a force has a true physical and indeed virtual vector direction, that is, the line along which it travels in order to achieve its aim.

Defining the Operating Environment: The Fluid and the Friction

Humanity now resides on the edge of two worlds, the virtual and the physical. Whilst it is not possible to place one's physical being inside the virtual environment, it is possible to prosecute the search for ideals in the virtual world and to use virtual means in the physical world.

Table 7 illustrates the fact that physical-based forces cannot exist or be applied in the virtual world. It is therefore perhaps incumbent on nations and other organizations trapped in the physical arena to force opponents either to use the physical world in which they have greatest influence or to develop methods of applying their own force in the virtual environment.

Table 7. Environments of Force Generation and Operation

Force	Exists or Derived in (Environment)	Can be applied in (Environment)
<i>Mpc</i>	Physical	Physical
<i>Mvc</i>	Virtual	Virtual and Physical
<i>Mpi</i>	Physical	Physical
<i>Mvi</i>	Virtual	Virtual and Physical

The consideration of environment is not only important because it is the arena in which operations take place, but also because it is the structure of the organization contained within the environment which gives the mass an objective directional vector within the force. The will, either individual or collective, simply gives a subjective directional vector. This consideration is particularly important when one considers the net-attack method of “swarming.”²⁰ In this scenario, instead of the more-conventional thought of attack where mass is concentrated before attack, the aggressor parts of the network will all swarm at one time to attack, adding a third dimension to this normally linear concept.

Combining the idea of virtual and physical mass with the two types of environment, one can construct a threat template for one’s opponent. The distribution of the mass, his capability, will depend on the nature of the opponent and on the type of mass he is capable of applying.

Threat Weakness and Operational Dilemmas

The problem for the modern threat comes in his attempts to apply force either in the virtual or physical environments. As with any form of action, telltale signs of the impending application of force must precede it. Whether in the real or virtual environment there must be some form of massing of capability before an assault. The difficulty for the nation-state is spotting when a networked organization does this. As the previous paragraph mentions,

swarming is a possible and difficult to foresee method of attack because it is multidimensional in nature. The traditional linear buildup to conflict, consisting of events such as political crisis, increased tension, troop build-up and mobilization of the nation-state paradigm is easy to understand. Nations must now consider how to recognize the preparatory phases of buildup in a network organization both in the physical and virtual environment.

Summary

In summary, nation-states face several challenges when dealing with a non-state actor, an opponent using asymmetrical means or another nation avoiding the most common strengths found in superpowers; these are:

1. Nation-states dominate the physical world but not the virtual environment and as such are geared toward destruction by physical not virtual means.
2. Nation-states are bound by laws existing in the physical realm that do not apply or are not relevant in the virtual environment.
3. Physical capabilities do not exist and cannot be applied in the virtual realm.
4. The hierarchical military system so common in nation-states does not allow for containment of and timely action against an enemy organized as a network.
5. The doctrinal level of war framework does not fit the global, multi-nodal network framework that can be applied today, a new construct needs to be considered.
6. The nature of the opponent and his capability will determine the distribution of his mass between the physical and virtual environment.
7. Networked organization must still execute traditional methods of force-application buildup methodology within either the virtual or the physical environment.

The future operating environment will be pan-national, both physical and virtual, capable of transcending all levels of war simultaneously, be inherently complex, outside the construct of the nation-state and be in a constant state of flux. Chapter 5 attempts to discern a model that can

be applied to the other areas of the new global operational environment, thereby bringing the complexity of a network physical and virtual environment into the realms of nation-state action.

¹ US Government National Intelligence Council, CIA Report "Global Trends 2015: A Dialogue about the Future With Non-Government Experts." [Article on-line]; available from <http://www.cia.gov/cia/publications/globaltrends2015/index.html>; Internet; accessed 1 April 2001, 5.

² Martin van Creveld, *The Transformation of War* (New York: The Free Press, 1991), 42.

³ Ibid., ix.

⁴ NIC CIA Report "Global Trends 2015," 9.

⁵ Ibid., 36.

⁶ Congress, Senate, Armed Service Committee, *Global Threats and Challenges Through 2015* (Washington, DC: FDCH Congressional Testimony, 2001), 6.

⁷ Qiao Lang and Wang Xiangsui, *Unrestricted Warfare*, trans., Foreign Broadcast Information Service (Beijing, China: Peoples Liberation Army Literature and Arts Publishing House, 1999).

⁸ LTC Bill Flynt, U.S. Army, "Threat Kingdom," U.S. Army Military Review, USACGSC, vol LXXX, no 4 (Jul/Aug 2000), 17.

⁹ Ibid.

¹⁰ Ibid., 19.

¹¹ Ibid.

¹² Flynt, 19.

¹³ NIC CIA Report "Global Trends 2015," 11.

¹⁴ US Army, FM 3-0, *Operations* (Washington DC: Department of the Army, June 2001), 2-2.

¹⁵ David Wood, "National Security After the Cold War: Boundaries Once Clear now in Chaos," *Navy Times* 49, no. 32 (15 May 2001): 24.

¹⁶ U.S. Army, FM 3-0, *Operations*, 2-2.

¹⁷ John Arquilla and David Ronfeldt, *Networks and Netwars: The Future of Terror, Crime and Militancy* (California: RAND Organization, 2001), 8.

¹⁸ NIC CIA Report "Global Trends 2015," 5.

¹⁹ Ibid., 8.

²⁰ Arquilla and Rondfelt, 12.

CHAPTER 5

WORKING MODELS

Introduction

Changes in the global system have meant that the connectivity of the three levels of warfare has blurred the boundaries, and in that respect it is better to consider the operational environment from a threat capability standpoint, that is by examining the ways rather than the means of threat employment.

This chapter examines the applicability of various theoretical systems in order to establish either a consolidated model applicable to the modern military for the examination of the modern operating environment. As Ludwig von Bertalanffy states in his book on general system theory "Models in ordinary language therefore have their place in systems theory. The idea retains its value even where it cannot be formulated mathematically, or remains a "guiding idea" rather than being a mathematical construct."¹

Operational Theoretical Trends

The complexity of the future operating environment has increased exponentially, but in essence it has in certain respects remained the same. At the tactical force-on-force level, it will remain necessary to employ direct physical force against one's opponent in order to compel him to do one's will. In this regard the standard Newtonian physic model shown in figure 4 applies.

$$\text{force (f)} = \text{Mass (m)} \times \text{acceleration(will)(a)}$$

Figure 4. Newton's Third Law of Motion

This is a construct which can be applied and understood by national actors. It flows well with the Trinitarian model of war where the army (mass) driven by the political ends (will) constitutes the force, but it falls short in today's global environment. Another theoretical mechanical model is that of fluid dynamics. This model fits particularly well to transitional phases of operations where nations of forces are not in the force-on-force, solid-on-solid state of conflict and where operations are shaping the three-dimensional battle-space within which operations will take place. When applied to a more-modern construct for the operational environment, it is with the maneuverist doctrine expounded in the late 1980s and early 1990s that this *fluid* theoretical approach to warfare fits particularly well.

However, when considering today's physical environment, one has greater difficulty in encapsulating the complete environment as a whole. Neither fluid dynamics nor laws of motion capture the concept of global spread and the diversity of the modern concept.

System Models

In considering this theory, one should note that the global environment is a system and in certain aspects conforms to and can be examined by using the rules of general system theory.² Ludwig von Bertalanffy developed general system theory as an amalgamation of several existing physical theories in the late 1940s. Bertalanffy emphasized that real systems are open to and interact with their environments and that they can acquire qualitatively new properties through emergence, resulting in continual evolution. Rather than reducing an entity (e.g., the human body) to the properties of its parts or elements (e.g., organs or cells), systems theory focuses on the arrangement of and relations between the parts which connect them into a whole.

System theory as with many complex physical theorems finds its explanation and analysis in the world of mathematics, which, although accurate, neither lends itself to simple explanation nor to its employment a basis for force development, per se.

Colonel John A. Wardon III, USAF, also considers the application of system theory to the enemy in his article, "The Enemy as a System," and argues.

If we are going to think strategically, we must think of the enemy as a system composed of numerous subsystems. Thinking of the enemy in terms of a system gives us a much better chance of forcing or inducing him to make our objectives his objectives and doing so with minimum effort and the maximum change of success.³

Colonel Wardon's theory goes on to explain the enemy system as a series of concentric rings in the center of which at the strategic level is the leadership and on the outside is the fielded military. One could further expand this construct to exemplify the idea of the rings surrounding the fielded military where once again the leadership is at the center. This idea may be applied to the structure of a network where each node could be considered a series of concentric rings, there may even be incidences where the rings of one node overlap another, perhaps causing friction and conflict or simply proving that communication between the two nodes is possible. In that insistence the final ring could even be virtual in nature, an unseen communications link between the two nodes. In short, there could be a mix of physical and virtual rings composing each node.

One thing, that can be extracted from general system theory, apart from the principle that systems are not closed and interact with their surroundings, is that a system can be analyzed by considering three things: (1) the number of parts in the system, (2) their species or type, and (3) their relationship with each other.⁴ This construct is particularly important when considering the makeup an interrelation of a network system employed by a non-state actor.

Chaos and Complexity

Certain laws, the most applicable of which stem from the study of chaos theory, bind the global operating environment. Chaos and complexity offer several possible models for inclusion in a theoretical construct of a modern-operating environment. Because of their nature, complexity and chaos are better described at the more advanced level, by mathematics. The theories of chaos and complexity offer this theoretical model two important features: the fractal nature of a network and the attraction of systems towards certain regulating factors.

Complexity within this system can be seen in the fractal nature of the breakdown of networks, unlike the hierarchical structure of military organizations which exhibit an almost regular repartition in the breakdown into sub-levels. Networks have a similar but less rigid construct. Figure 5 shows the complexity in both a hierarchical and network system and figure 6 illustrates the unstructured complexity in a network model.

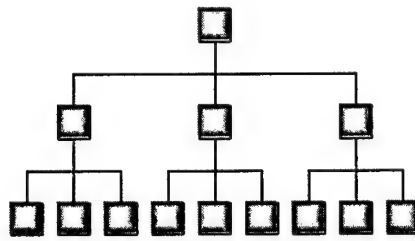


Figure 5. Ordered Complexity in a Hierarchical Structure

Although simplistic in its design, figure 5 illustrates the linear nature of a standard hierarchical system. Each subsequent level is a further breakdown of the level above. This system tends to be rigid in thought and action and therefore relatively inflexible and slow to react. It is also vulnerable to decisive action and is easily understood, preempted, and templated.

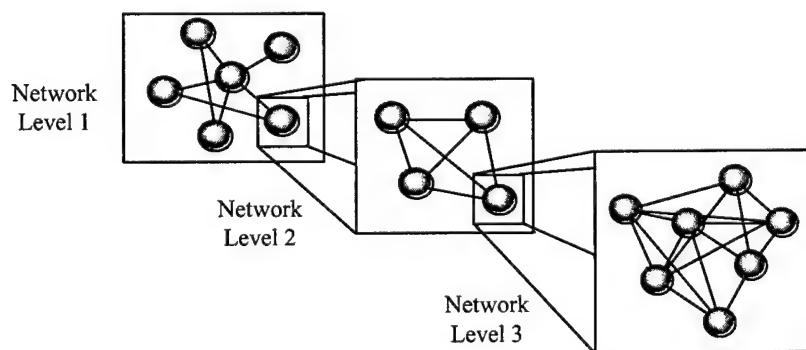


Figure 6. Unstructured Complexity in Network Models

Although figure 6 shows a linear progression, the reality may in fact be even more complex in that a node on the level 3 model could also be a node on the level 1 network. This would give the two-dimensional representation shown in figure 6, a third dimension. The network system is more reactive, harder to template, and more difficult to destroy with one decisive action.

Putting this construct together with Wardon's concentric ring theory one could envisage the result shown in figure 7.

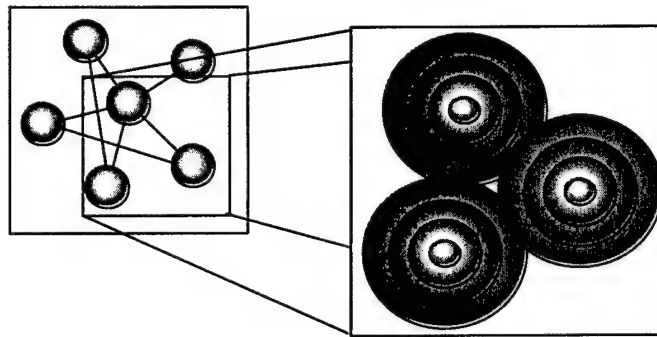


Figure 7. Networks and Concentric Rings

In this case, the outer ring of the node is a communications capability which could exist in either the physical or virtual world. Putting the theoretical construct aside, the model shows the depth of complexity in the network system. The further one tries to examine the nature of this system with models it seems the greater the resemblance of the structure to that of the electronic cloud surrounding atoms at the atomic level--the more the idea tends toward a gaseous model.

Another attribute of chaos theory, which may be applicable, theoretically at least within the global model, is that of attractors.⁵ The concept of systems being attracted to four basic types

of attractor, *fixed point*, *limit cycle*, *torus*, and *strange*, could be applied theoretically at least to the construct for the modern-operating environment.

Realistically, the global operating system would tend to be attracted to a *strange* and immensely complex or a set of several forms of attractors, too complex for use in the realm of theoretical operational design. Perhaps a better and simpler model would be that of the limit cycle attractor where the system returns to a cyclic state of equilibrium irrespective of the amount of changes made to the system. There are, of course limits, to the amount of change that can take place, but theoretically and as a construct, the limit cycle attractor enables one to understand that a force-on-force, system-on-system interaction has a tendency to return to a balanced situation.⁶ The system continues to return to a state of equilibrium irrespective of the amount of pressure exerted by either side because of a balancing mechanism inherent in the system. John F. Schmitt sites the example of the trench deadlock during the First World War as an example of a similar regulatory system--entropy.⁷ Molecules in a gas exhibited entropy by moving to create the maximum possible even distribution within the system, in doing do they paradoxically create the greatest amount of disorder.

The two concepts discussed so far are important for understanding the modern operating environment in so far as they allow one to understand the fact that the system will return to a position of stability even when action occurs within it and that the complexity of network organizations are more than simply two-dimensional.

Newtonian Physics and General Theories of Reductionism

As argued in the previous chapter, the physical state-on-state application of force is still possible, and in such instances, the pursuit of policy by military means and the Newtonian physical model of the laws of motion remain applicable. The theories of Newtonian physics offer more than a simple reductionism approach to physics. Fluid dynamics and the general gas law can

equally be applied to various operational models and to actors in various states of operation. The consolidated model in the next section explains the application of mechanical theory.

Consolidated Model

Since reviewing a great deal of the current literature underpinning the doctrine of both the USA and UK, it seems that the current construct for modeling the operational environment is still locked within the bipolar, socialist-capitalist era. The new model for the modern operating environment sees a much more diverse and flexible construct where the overall theory takes into account the systemic nature of the environment, a balancing mechanism and where several states of conflict can occur at the same time, in different parts of the model.

The modern-operating environment has an inextricably intertwined nature, between the physical and virtual world, and the model; or in this case tends toward that of a gas where the particular motion contained therein is the free movement of the constituent molecules of the gas. If one envisions this on a global scale, there would be events or conflicts taking place around the world, meaning that at any one time the gas would contain forces in conflict (solid-on-solid warfare) and forces moving to and from conflict at the operational level, perhaps in a more fluid state. This paper therefore proposes that an applicable construct for the modern-operating environment, primarily because of its global networked nature, is that of a gas.

Applying gaseous pressure to a solid requires a concentration of effort and decrease in volume, in other words, one must begin to change state in order to affect other actors. If this is true it should then be theoretically reliable that the best mode of applying force is done in the same state as one's opponent, this does not rule out other methods or combinations but ensures similar environments of operations.

Overall Concept

This thesis suggests that the ideal gas law is a reasonable construct for considering the modern operating environment. Figure 8 shows an explanation of the standard ideal gas law,

according to normal physical models and an extrapolation of the variables into the modern operating arena.

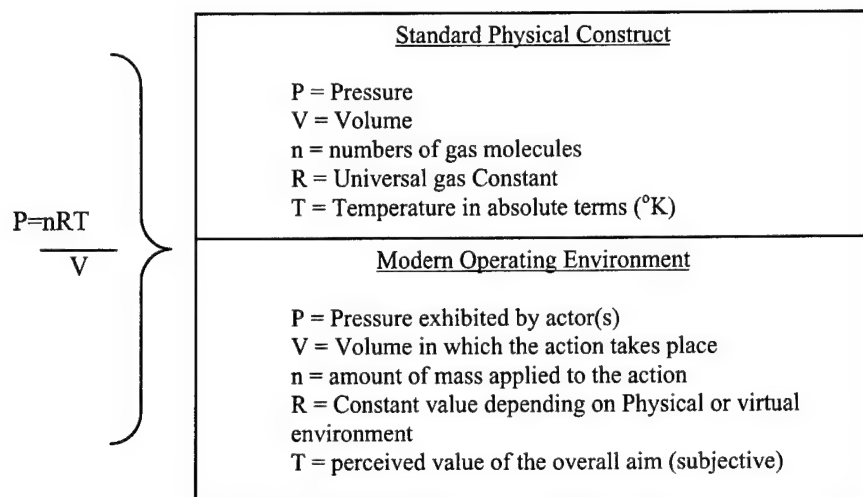


Figure 8. The Application of the Ideal Gas Law

In essence, the law states that for a given amount of gas molecules at a given temperature the pressure will remain constant. If the number of molecule and temperature are increased or the volume of the container is decreased, the pressure within the system increases. The effect in the modern-operating environment is similar in that the pressure exerted by an actor depends upon the amount of substance he applies (n), in which environment he is operating (virtual or physical), how much conviction the cause has (hence the subjectivity of T), and within what volume he is trying to apply the force. This model also works for the nation-state in applying force to a non-state actor. Arguably in the case of a state, the value T would be a constant as a one can assume that action is taken for military reasons which will always have the same subjective value.

Chapter 4 describes a physical and virtual environment in which the modern-operating environment can exist; to that end, there must be two possible models where the constant R is

different in each case. Figure 9 shows the possible formulae for actions in the physical, virtual, and combination of actions in both environments simultaneously.

<p><u>Modern Operating Environment Physical</u></p> $P = \frac{np \times Rp \times T}{Vp}$
<p><u>Modern Operating Environment Virtual</u></p> $P = \frac{nv \times Rv \times T}{Vvp}$
<p><u>Modern Operating Environment Virtual</u></p> $P = \frac{(np+nv) \times (Rp+Rv) \times T}{Vvp^2}$

Figure 9. Resolution of Physical and Virtual Model Equations

As the last equation shows, it should be possible to resolve the effect of a force applied in both environments. The value of T clearly remains constant, as the *will* is the same in either environment. This having been said, T is a vector quantity which applies direction and meaning to the acceleration and application on the mass (n). It is therefore a variable that can be adjusted throughout the course of a campaign in order to affect the state of matter of the opposing force.

It should also be noted that because a virtual mass can operate in the physical realm, the volume in the virtual equation can be in either environment; this means that there is a squared effect when combining the equations. In essence, it could be argued that virtual mass has a greater effect than physical mass within a global environment. In an attempt to give some value to the variable T, one could apply the McKinsey uncertainty levels described in table 1. Another construct could be a sliding scale based on the general construct shown in table 8.

Table 8. Ascribing a Numerical Value to Will

Will Motivation	Greater Value	Example
Subjective Collective		Mass movement
Subjective Individual		Faith
Objective Collective		Personal Monetary Gain
Objective Individual		Political Reasons
	Lesser Value	

Example

In the traditional linear operating environment, one could vary the application of the mass (the force) by changing the direction of the will, the quantity of the will and the size of the mass. Nowhere in the Newtonian construct is it possible to affect the environment in which opposing forces act.

In the model suggested above, one can vary the amount of mass (n) employed within the environment, and also the direction of and amount of acceleration (T). This model varies from the previous theoretical model in that one can vary the size and construct of the environment in which forces act (V). For example, governments do not necessarily need to increase the size of a military force in a particular theater. By influencing the exterior of the operating environment through the application of other parts of the DIME, the size of the operating environment can be either reduced or increased as required. If one decreases the size of the environment, then the amount of pressure increases thereby increasing the overall effect of the application of military force on that environment.

Summary

Chapter 5 proposes that the modern-operating environment is analogous to the structure of a gas and that by using modification of the ideal gas one can examine the system in greater detail. Some general findings from this analysis have been:

1. The effect of virtual mass is greater than that of physical mass because it can operate in either environment. In addition, physical effects are more likely to be permanent than virtual effects, which are more likely to be transient.

2. The modern-operating environment should be considered in terms of an open system and examined using the construct within general system theory of parts, species, and interrelation.

3. The modern-operating environment, like other systems, will tend toward a stable attractor. In other words, it is almost impossible to change a system radically for an extended period of time.

4. Networks are complex organizations that exhibit three-dimensional characteristics, complex structures, and an inherent adaptation capability.

In conclusion, the molecular behavior and movement in a gas known as entropy could be likened to that of the random movement of a majority of the people and organizations around the world. The free movement of the neutral population that hides the action of the terrorist or the movement of WMD between nation states paradoxically links back to a Clausewitzian theory that has been discussed at length for many years--this random hazing movement in the operational environment is similar to the Prussian theorist's concept of the fog of war.

¹ Ludwig von Bertalanffy, *General System Theory: Foundations, Development and Applications* (New York: George Braziller, 1968), 24.

² Bertalanffy, 53.

³ John A. Wardon, USAF "The Enemy as a System" [Article online]; available at <http://www.cgsc.army.mil/usaf/pubs/enemysystem.htm>; Internet; accessed 21 August 2001, 2.

⁴ Bertalanffy, 53.

⁵ John Briggs and F. David Peat, *Turbulent Mirror: an Illustrated Guide to Chaos Theory and the Science of Wholeness* (New York: Harper and Row Publishers, 1989), 32.

⁶ Ibid., 39.

⁷ John F. Schmitt, "Command and (Out of) Control: The Military Implications of Complexity Theory, [Article online]; available at <http://www.ndu.edu/ndu/inss/books/complexity/ch09.html> Internet; accessed 5 September 2001, 7.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

Change alone is unchanging.

Herakleitos, *Herakleitos and Diogenes*

Introduction

This paper has examined the modern-operating environment, an environment that is inherently different from that of the cold war paradigm and indeed different from the wars of the nation-states models employed to develop the early military theories. Military theory, like scientific physical theory, must look at the fundamentals that formed the shape and the beliefs that are held dear by today's military doctrine writers and theorists.

Carver Mead, a leading physicist, talks about the fundamental changes needed in the world of physics and in particular within the understanding of the relationship between quantum mechanics and the "classical Newtonian world."¹ Mead highlights the mistakes made by recent physicists in the analysis of the world. He notes, "They wanted to make the quantum domain to approximate the classical Newtonian world. And it simply doesn't."² He describes the recent past as the "dark age." Modern thinking and a new understanding have brought a new realization that the world has different laws and principles for different levels, "They [physical systems] are dominated by different sets of physical laws."³

The increased complexity of the world in which humanity lives and operates means that nations are inextricably linked and locked within the system. Nations cannot take military action on one side of the world without its repercussions being felt thousands of miles away.

Summary of Monograph Findings

In summary, the great and superpower nation-states face several challenges when dealing with a non-state actor, an opponent using asymmetrical means or another nation avoiding the

most-common strengths found in superpower and great-power. This monograph has twelve main findings:

1. The effect of virtual mass is greater than that of physical mass because it can operate in either the physical or the virtual environment physical effects are more likely to be permanent than virtual effects, which are more likely to be transient.
2. The modern-operating environment should be considered in terms of an open system and examined using the construct within general system theory of parts, species, and interrelation.
3. The modern-operating environment, like other systems, will tend toward a stable attractor. In other words, it is almost impossible to change a system radically for a extended period of time, it will tend back to its former state.
4. Networks are complex organizations that exhibit three-dimensional characteristics, complex structures, and inherent flexibility of adaptation.
5. Nation-states dominate the physical but not the virtual environment and as such are geared toward detection, shaping, and destruction using physical not virtual means.
6. Nation-states are bound by laws existing in the physical realm that do not apply or are not relevant in the virtual environment.
7. Physical capabilities do not exist and cannot be applied in the virtual realm.
8. The hierarchical system so common in nation-states is too rigid and does not allow for containment of and timely action against an all-channel network.
9. The doctrinal "level of war" framework does not fit the global, multi-nodal network framework that can be applied today.⁴ A new construct needs to be considered.
10. Because of its importance and the interconnected nature of the global environment, information can now exhibit mass-like characteristics.
11. The nature of the opponent and his capability will determine the distribution of his mass between the physical and virtual environment.

12. Networked organization must still execute traditional methods of force-application buildup methodology within either the virtual or the physical environment.

These can be grouped into three main areas.

The Virtual Environment

It is now possible for adversaries of the nation-state to use available technology to apply force in a virtual environment. This virtual mass can exhibit force in both the physical and virtual environment. This will be problematic for the nation-state as its power (because of its structure) lies in the physical domain, in which it is bound by laws that are not applicable in the other arena. Moreover, nation-states cannot apply physical means in the virtual world. Information and energy will form the mass in the virtual environment.

Systemic Structure

Because of the structure of the globe and its communication, banking, and information system, the future opponent will be capable of exploiting the global-operating system as a whole, thereby transcending the current construct of the "levels of war." In essence, actors are no longer bound to operating within a strict, strategic, operational and tactical construct. In this system, nations will need to examine the parts, interrelation and nature of the pieces of the system in order to begin to understand the nature of the opponent that they face today. However, because the modern operating environment is a system, it will tend toward stability; the entropic behavior of the parts of the system will disperse action and affect the military force applied to the opponent. Combatants need to understand that the temporal opportunity where one would hold the initiative will be reduced in the modern-operating environment.

Networks

Both the virtual environment and the physical dispersion of the future opponent will mean that the organizational structures faced by the nation-state will no longer be linear. The all-

informed network of the opponent will be eminently flexible making him capable of striking from any direction at any time, with minimal preparation. This structure coupled with the mass he will employ and his choice of operational environment will determine the spread of his capabilities, in essence, his potential for power. However, in order to produce an effect, the future opponent must mass in some form to apply pressure in either the physical or the virtual environment. In doing so, he will provide clues to his methods, show his weaknesses, and most importantly, change his physical shape toward that most understood and most vulnerable to action from the nation-state--a solid.

Answering the Thesis Question

This paper concludes that the current theoretical model for the modern-operating environment will not be applicable in the twenty-first century. The prescriptive, linear, methodical approach to warfare ties the hands of nations to too great an extent. The implications of this finding are far reaching; nations should analyzing current doctrine and procedures to consider the applicability of the findings of this paper.

Doctrinal Implications

In line with Carver Mead and the reconsideration of the fundamentals of physics, the nation-state should consider the possible implications of a new operating environment on their methods of force application.

Lieutenant Colonel Robert Leonhard examines the nine US Army principles of war in his book *Principles of War for the Information Age*.⁵ Leonard compares the current principles of war against those he has developed for the twenty-first century and analyzes the applicability of each. In line with that idea, this paper looks briefly at the impact of the thesis model on current doctrine.

Clearly, the key to the correct application of force is the plan. The US Army derives its plan at the operational level by using the "Elements of Operational Design."⁶ The British Army

uses a similar construct in “The Concepts of Operational Design.”⁷ Although the parts of operational design differ in number and slightly in definition between the two nations, overall the major components either are the same or have essentially the same definition.

As a new construct for campaign analysis at the operational level where virtual operations are considered in unison with conventional physical actions, this paper examines the possible implication of some of the thesis findings on the key elements of campaign design.

The Future Design for Operations

Operational Objectives

Operational objectives have traditionally existed in the physical realm meaning the ability to focus mass on a physical target was possible. Future operational objectives will be more difficult to define or discover. The combination of environment, system, and network organization will afford the opponent greater opportunity for refuge, thereby making it more difficult to define and in some cases pursue a final objective.

The End-State

The construct of end-state will probably remain the same. However, there may be a need to define both a physical and virtual end-state for an operation.

Center of Gravity and Decisive Points

As with the concept of end-state, it is feasible that one's opponent may have both a physical and virtual center of gravity and, therefore virtual decisive points. Traditional COE COG and decisive points manifested themselves in the physical environment, the future decisive points and centers of gravity will exist in both environments. Figure 10 is a diagrammatic representation of a possible campaign plan structure within the modern-operating environment.

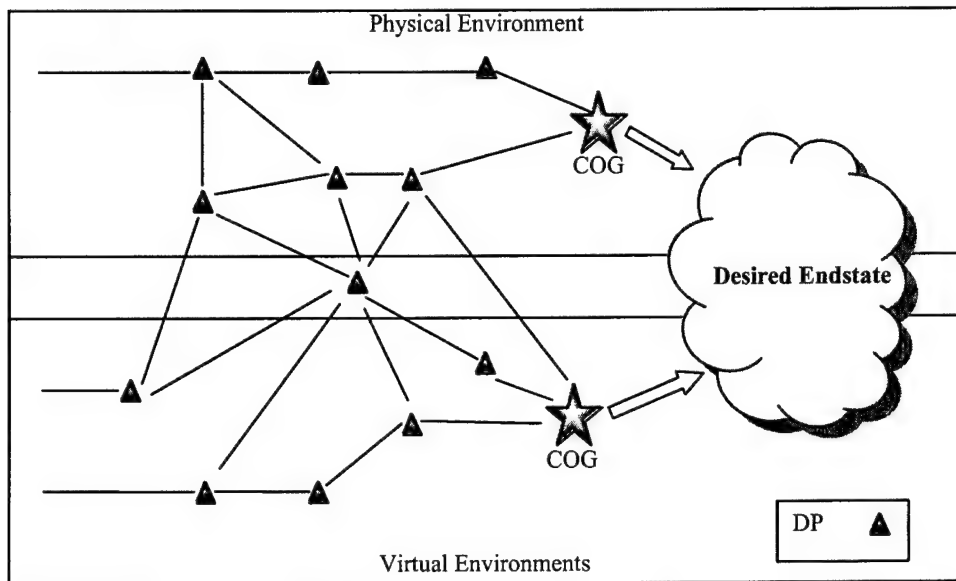


Figure 10. Modern Operating Environment Campaign Structure

Lines of Operation

The structure of a campaign plan may now need to include not only a functional line of operation covering information but also perhaps a complete campaign plan taking into account the virtual environment as a separate entity in itself. The shift in COE will make the definition and delineation of lines of operation more difficult. As shown in figure 10, the complexity of the interlinking of lines of operation between virtual and physical environment will make delineation more difficult.

Maneuver

The current idea of maneuver used by masses to apply a force to a certain part of the enemy or the battlefield will change dramatically. Maneuver must be considered in both virtual and physical terms. It will be necessary for nations to be able to negotiate the virtual environment as adeptly as they currently do the physical. Moreover, they will also need to be able to

maneuver to concentrate mass or threaten to apply mass, in the same conceptual way as before, but this time in two difference environments simultaneously.

Tempo

The maintenance of tempo in the modern-operating environment will be much more difficult to achieve. Both the physical and virtual arenas will offer the opponent greater opportunity for escape. The interconnected nature of the future system will also allow the system to stabilize much faster, meaning that the time available to seize and maintain tempo in either environment will be greatly reduced. This problem calls for a more flexible, responsive organizational structure within national militaries.

Shortfalls and Further Study

There is a great deal more work that could be done in examining the findings of this thesis in relation to possible changes in doctrine or force employment. Several areas where the thesis failed to examine or where time and space constrained analysis are:

1. The employability of the model in shaping the operational environment to force one's opponents to change state and therefore become vulnerable to nation-state mass.
2. The impact of the model of military force structure and operations as well as doctrine
3. Development of values for T and V
4. Development of volume and location of application ideas for the model
5. Fully analyze the implications of the model on military doctrine
6. Develop further the construct for campaign planning in the modern operating environment.
7. An analysis of the value of considering the levels of war construct a functional rather than hierarchical terms

Conclusion

In conclusion, there are perhaps two issues that can be addressed by nations in order to achieve some level of success in moving toward a more-contemporary understanding of the modern-operating environment.

First of all, one's opposition must be considered to exist in all states of matter, the opponent will hide in the gaseous motion of general population movement, he will transition to operations through the liquid form, becoming easier to detect, his actions will be more prescribed and threat-like. Finally, he will apply force either in the physical or virtual environment. Nations should not just understand warfare as a system but begin to see the enemy as a system also.

Second, nations should look at shaping the external environment, not just the operational one. As will any gas, if one reduces the size of the container, the gas compresses, increasing the energy in the vessel, either of two things will occur: (1) the pressure will become so great that the gas will yield and change state into a liquid and then into a solid. Alternatively, (2) the internal pressure of the gas will break the container thereby metaphorically forcing the hand of the opponent and exposing his position.

Different laws and principles from those currently understood control the two operational environments covered in this paper; let the Aries of the UK and US not make the virtual environment fit the classical physical domain, and head into what may well become known as "the dark age of military thought."

¹ Carver Mead, "The Spectator Interview," *The American Spectator*, 34, no. 7 (September-October 2001): 68-75, 72.

² Ibid.

³ Ibid.

⁴ U.S. Army, FM 3-0, *Operations*, 2-2.

⁵ Robert R. Leonhard, *The Principles of War for the Information Age* (California: Presidio Press, 1998).

⁶ U.S. Army, FM 3-0, *Operations*, 5-6.

⁷ British Army, *Army Doctrinal Publication: Operations*, vol. 1 (London: HQDT, 1994), 3-8.

APPENDIX A

DIAGRAMATIC MONOGRAPH METHODOLOGY

Figure 11 is a diagrammatic representation of the methodology the monograph will follow.

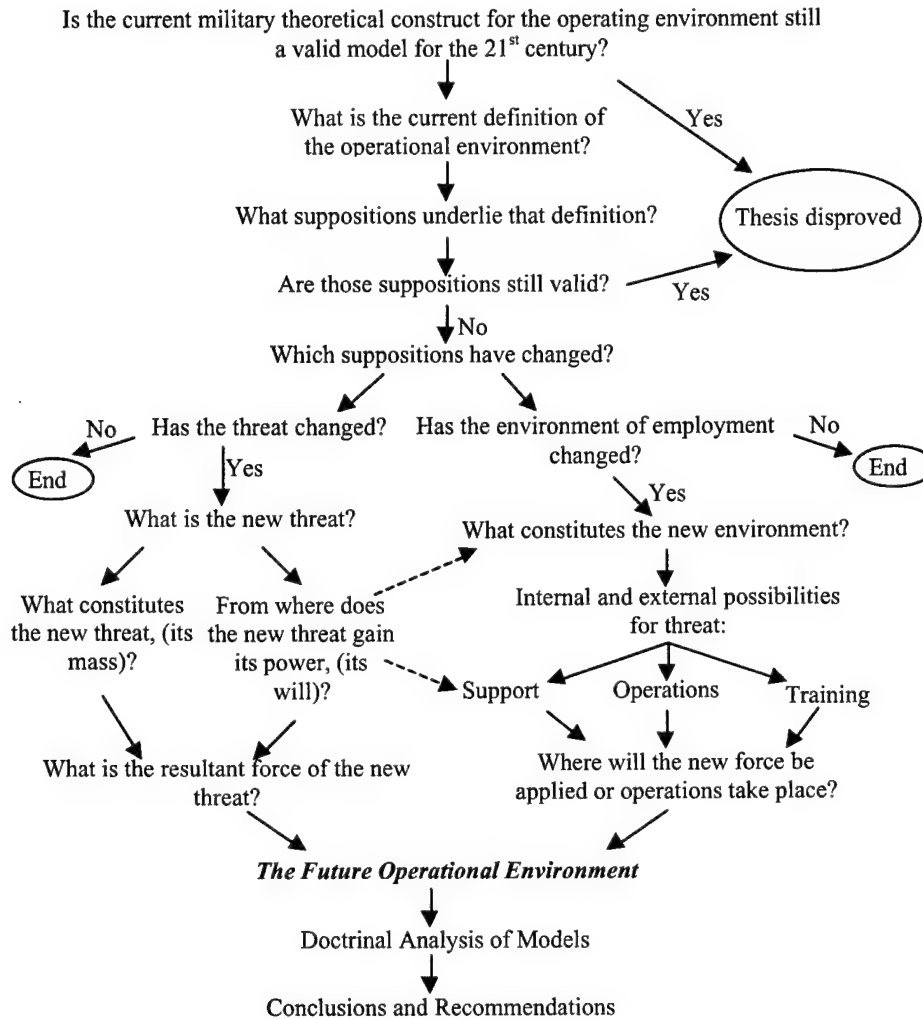


Figure 11. Diagrammatic Thesis Methodology

BIBLIOGRAPHY

Books

- Arquilla, John and David Ronfeldt. *Networks and Netwars: The Future of Terror, Crime and Militancy*. California: RAND Organization, 2001.
- Bellamy, Christopher. *The Future of Land Warfare*. New York: St. Martin's Press, 1987.
- Bertalanffy, Ludwig von. *General System Theory: Foundations, Development and Applications*. New York: George Braziller, 1968.
- Bloch, Ivan S. Jean de. *The Future of War*. Boston: The World Peace Foundation, 1914.
- Briggs, John, and F. David Peat. *Turbulent Mirror: An Illustrated Guide to Chaos Theory and the Science of Wholeness*. New York: Harper and Row Publishers, 1989.
- Clausewitz, Carl von. *On War*. Edited and translated by Michael Howard and Peter Paret. Princeton, New Jersey: University Press, 1984.
- Clark, Wesley K. *Waging Modern War: Bosnia, Kosovo and the Future Combat*. New York: Public Affairs, 2001.
- Davus, Jacquelyn K., and Michael J. Sweeney. *Strategic Planning 2025: U.S. Security Planning for a New Era*. Herndon, VA: Brassey's, 1999.
- Friedman, George and Meredith Friedman. *The Future of War: Power, Technology and American World Dominance in the Twenty-First Century*. New York: St Martin's Press, 1998.
- Friedman, Thomas L. *The Lexus and the Olive Tree*. New York: Random House Books, 2000.
- Glenny, Misha. *The Balkans: Nationalism, War and The Great Powers, 1804 -1999*. Harmondsworth, England: Penguin Books, 1999.
- Gordon, Michael R., and Bernard E Trainor. *The General's War: The Inside Story of the Conflict in the Gulf*. New York: Little Brown Books, 1995.
- Handel, Michael L. *The Masters of War: Classical Strategic Thought*, 3d ed. London: Frank Cass Publishers, 2001.
- Hartle, Anthony E. *Moral Issues in Military Decision Making*. Kansas: University of Kansas Press, 1989.
- Ignatieff, Michael. *Virtual War: Kosovo and Beyond*. New York: Henry Holt and Company, 2000.
- Kaplan, Robert D. *The Coming Anarchy: Shattering the Dreams of the Post Cold War*. New York: Random House, 2000.

- _____. *Eastward to Tartary: Travels in the Balkans, Middle East, and Caucasus*. New York: Random House, 2000.
- Keegan, John, ed. *The Book of War*. Harmondsworth, England: Penguin Books, 1999.
- _____. *The History of Warfare*. New York: Random House, 1993.
- Klein, Gary. *Sources of Power*. Massachusetts: Massachusetts Institute of Technology, 1998.
- Kissinger, Henry, Ph.D. *Diplomacy*. New York: Touchstone Books, 1994.
- Lang, Qiao and Wang Xiangsui. *Unrestricted Warfare*. Translated by Foreign Broadcast Information Service. Beijing, China: Peoples Liberation Army Literature and Arts Publishing House, 1999.
- Leonhard, Robert R. *The Principles of War for the Information Age*. California: Presidio Press, 1998.
- Mann, Michael. *The Sources of Social Power*. London: University of Cambridge Press, 1986.
- Mintzberg, Henry. *The Rise and Fall of Strategic Planning*. New York: Free Press, 1994.
- Naveh, Shimon. *In Pursuit of Military Excellence: The Evolution of Operational Theory*. London: Frank Cass Publishers, 1997.
- Rosen, Stephen P. *Winning the Next War*. New York: Cornell University Press, 1991.
- Schneider, Barry R., and Lawrence E. Grinter. "Battlefield of the Future: 21st Century Warfare Issues." *Air War College Studies in National Security* 3d ed. Alabama: Air University Press, 1995.
- Schneider, James J., Ph.D. *The Structure of Strategic Revolution*. Novato, California: The Presidio Press, 1994.
- Simpkin, Richard E. *Race to the Swift: Thoughts on Twenty-First Century Warfare*. London: Brassey's Defense Publishers, 1985.
- Svechin, Aleksandr A. *Strategy*. Minnesota: East View Publications, 1992.
- Toffler, Alvin, and Heidi Toffler. *War and Anti-War*. New York: Warner Books, 1993.
- Van Creveld, Martin L. *The Transformation of War*. New York: The Free Press, 1991.
- Waldrop, M. Mitchell. *Complexity: The Emerging Science at the Edge of Order and Chaos*. New York: Touchstone, 1992.
- Wyld, Henry, W. *Mathematical Methods for Physics: Lecture Notes and Supplements in Physics*. Massachusetts: Addison-Wesley Publishing, 1928.

Articles and Periodicals

- Coyne, Kevin P., and Somu Subramaniam, "Bringing Discipline to Strategy." *The McKinsey Quarterly*. 3 (October 2000): 61-70.
- Flynt, W., LTC, U.S. Army. "Threat Kingdom." *Military Review*, 80, no. 4 (July-August 2000): 12-21.
- Hillen, John. "Must U.S. Military Culture Reform." *Parameters* 29 (autumn 1999): 9-23.
- Livingstone, Neil C., Ph. D. "Fighting Terrorism and Dirty Little Wars." *Air University Review* 35, no. 3 (March-April 1984): 4-16.
- Mead, Carver. "The Spectator Interview." *The American Spectator* 34, no. 7 (September-October 2001): 68-75.
- Schneider, James J., Ph. D. "The Theory of the Empty Battlefield." *Journal of the Royal United Services Institute (RUSI) for Defense Studies*, September, 1987: 37-44.
- _____. "What if We Fight Tonight: Advanced Military Education for the XXIst Century." *Association of Advanced Operational Studies NET Call 2* (fall-winter 1994-95): 3-9.
- Stroup Jr., Theodore G. "The Ongoing Army Transformation." *Army* 50 (July 2000): 7-10.
- Wood, David. "National Security After the Cold War: Boundaries Once Clear now in Chaos." *Navy Times* 49, no. 32 (15 May 2001): 24-25.

Government Documents

- British Army. Directorate General Development and Doctrine. "The Future Operational Environment: Implications for Future Army Force Development." Development Paper. Upavon: United Kingdom, Directorate General Development and Doctrine Jan 00.
- Parliament. British Government. *The Strategic Defence Review*. London: The Stationery Office, 1998.
- U.S. Air Force. "Global Engagement: A Vision for the 21st Century Air Force." Article on-line. Available from [http://www.cgsc.army.mil/usaf/Pubs/Global Engagement.htm](http://www.cgsc.army.mil/usaf/Pubs/Global%20Engagement.htm). Internet. Accessed 21 August 2001.
- U.S. Congress. Senate. Armed Services Committee. *Global Threats and Challenges Through 2015*. Washington, DC: FDCH Congressional Testimony, 2001.
- U.S. Department of Defense. *The Quadrennial Defense Review Report*. Washington, DC: Department of Defense, Sep 01.
- _____. *The Quadrennial Defense Review Report 1997*. Washington, DC: Department of Defense, 1997. Report online. Available from <http://www.defenselink.mil/pubs/qdr/sec4.html>. Internet. Accessed 20 Jan 2002.
- U.S. Army. FM 3-0: *Operations*. Washington, DC: Department of the Army, June 2001.

- _____. FM 100-5: *Operations*. Washington, DC: Department of the Army, 1993.
- _____. FM 101-5: *Staff Organization and Operations*. Washington, DC: Department of the Army, 1997.
- _____. FM 101-5-1: *Operational Terms and Graphics*. Washington, DC: Department of the Army, 1992.
- _____. *Transformation Campaign Plan*. Washington, DC: Department of the Army, April 2001.
- _____. TRADOC/DCSINT. "The Future Operating Environment." Draft paper. Fort Leavenworth: Kansas, May 2001.
- _____. TRADOC/DCSINT. "The Attack on America and The Implications of The Future Operating Environment: The first War of the 21st Century." Draft Paper. Fort Leavenworth: Kansas, Sep 2001.
- U.S. Department of Defense. *Joint Publication 1-02: Department of Defense Dictionary of Military and Associated Terms*. Washington, DC: Government Printing Office, 1994.

Monographs, Reports, Theses, and Unpublished Works

- American Council for the University of the United Nations. "State of the Future: Issues and Opportunities." Report Online. Edited by Jerome C. Glenn and Theodore J. Gordon. Available from <http://www.geocities.com/~acunu/millennium/sof/issues.html#2.1>, Internet. Accessed 21 Nov 01.
- _____. "Global Challenges for Humanity: UN Millennium Summit and Forum 2000." Special ed. Edited by Jerome C. Glenn and Theodore J. Gordon. New York, UN University, September 2000.
- Davis, Edward LTC (Ret), Robert H. Dorf, and Robert D. Waltz LTC (Ret), "A Brief Introduction to Concepts and Approaches in the Study of Strategy." In "U.S. Army Command and General Staff College C/M/S 500 Fundamentals of Operational Warfighting." U.S. Command and General Staff College, Fort Leavenworth, Kansas: L1-A-12.
- Gyllensporre, Dennis T., LTC, Swedish Army. "Adding Nonlinear Tools to the Strategist's Toolbox." MMAS Thesis, U.S. Army Command and General Staff College, Fort Leavenworth, Kansas, 2000.
- Heinemann, Timothy, Col. U.S. Army. "The 18 P's – A XXI Century Problem Analysis Model." Memorandum, Fort Leavenworth: U.S. Command and General Staff College, March 2001.
- Hulme, Simon J., "The Modern Media: Its Impact on Foreign Policy." MMAS Thesis, U.S. Army Command and General Staff College, Fort Leavenworth, Kansas, 2000.

National Commission on Terrorism. "Countering the Changing Threat of International Terrorism." Report online. Available from <http://www.fas.org/irp/threat/commission.html>. Internet. Accessed 9 September 2001.

Schneider, James J., Ph. D. "Theoretical Paper Number 3: The Theory of Operational Art." Theoretical Paper, School of Advanced Military Studies, U.S. Army Command and Staff College, Fort Leavenworth, Kansas, March 1988.

_____. "Theoretical Paper Number 4: Vulcan's Anvil." Theoretical Paper, School of Advanced Military Studies, U.S. Army Command and Staff College, Fort Leavenworth, Kansas, June 1991.

Smith, Rupert, Gen. The Kermit Roosevelt Lecture Series. Speech. British Army Staff Conference, Washington, DC, 28 September 2001.

Whitting, Chris, Major. "When David Become Goliath: The Israeli Withdrawal From South Lebanon." MMAS Thesis, U.S. Army Command and General Staff College, Fort Leavenworth, Kansas, 2000.

Electronic Sources

BBC Report. "Bin Laden's Options." BBC News Article on-line. Available from http://news.bbc.co.uk/1/hi/english/world/south_asia/newsid_1556000/1556541.stm. Internet. Accessed 21 September 2001.

BBC Report. "Tackling Terror With Technology." BBC News Article on-line. Available from http://news.bbc.co.uk/1/hi/english/sci/tech/newsid_1555000/1555981.stm. Internet. Accessed 21 September 2001.

British Army. "Future Army Concept Paper." HMSO; paper online. Available from <http://www.parliament.the-stationery-office.co.uk/pa/cm199900/cmhansrd/vo001023/text/01023w08.htm>. Internet. Accessed 21 November 2001.

CIA Report. Global Trends 2015: A Dialogue about the Future With Non-Government Experts." Article on-line. Available from <http://www.cia.gov/cia/publications/globaltrends2015/index.html>. Internet. Accessed 1 April 2001.

Tung, Mao Tse. *The Selected Works of Mao Tse Tung*. Article on-line. Available from <http://www.marx2mao.org/Mao/BSBA45.html>. Internet. Accessed 5 March 2002, 81.

National Commission on Terrorism. "Countering the Changing Threat of International Terrorism: Report of the National Commission on Terrorism." Report on-line. Available from <http://www.fas.org/irp/threat/commission.html>. Internet. Accessed 15 September 2001.

Schmitt, John F. "Command and (Out of) Control: The Military Implications of Complexity Theory." National Defense University. Article on-line. Available from <http://www.ndu.edu/ndu/inss/books/complexity/ch09.html>. Internet. Accessed 5 September 2001.

Wardon, John A. "The Enemy as a System." Article on-line. Available from <http://www.cgsc.army.mil/usaf/Pubs/Enemysystem.htm>. Internet. Accessed 21 August 2001.